IDENTIFICATION OF COMPLEX CULPRIT LESION ANATOMY WITH hs CRP IN UNSTABLE ANGINA

Dissertation submitted for

D.M. DEGREE EXAMINATION

BRANCH II – CARDIOLOGY

MADRAS MEDICAL COLLEGE

AND

GOVERNMENT GENERAL HOSPITAL

CHENNAI – 600 003

THE TAMIL NADU DR.M.G.R MEDICAL UNIVERSITY

CHENNAI – 600 032

AUGUST 2010

"learn to heal"

CERTIFICATE

This is to certify that the dissertation entitled **"IDENTIFICATION OF COMPLEX CULPRIT LESION ANATOMY WITH hs CRP IN UNSTABLE ANGINA"** is the bonafide original work of **DR.S.MURUGAN** in partial fulfilment of the requirements for D.M. Branch-II (CARDIOLOGY) examination of THE TAMILNADU DR.M.G.R.MEDICAL UNIVERSITY to be held in August 2010. The period of post-graduate study and training was from July 2007 to July 2010.

THE DEAN,
MADRAS MEDICAL COLLEGE &
GOVERNMENT GENERAL HOSPITAL
CHENNAI - 600 003.

PROF.GEETHA SUBRAMANIAN M.D., D.M.
F.M.M.C, F.I.S.E., F.C.S.I., F.I.S.C., F.I.A.E.,
PROFESSOR AND HEAD,
DEPARTMENT OF CARDIOLOGY,
MADRAS MEDICAL COLLEGE &
GOVERNMENT GENERAL HOSPITAL
CHENNAI - 600 003.

DECLARATION

I **Dr. S.MURUGAN,** solemnly declare that this dissertation entitled, **"IDENTIFICATION OF COMPLEX CULPRIT LESION ANATOMY WITH hs CRP IN UNSTABLE ANGINA"** is a bonafide work done by me at the department of Cardiology, Madras Medical College and Government General Hospital during the period 2007 – 2010 under the guidance and supervision of the Professor and Head of the department of Cardiology, Madras Medical College and Government General Hospital, Professor **Geetha Subramanian M.D.D.M., F.M.M.C, F.I.S.E, F.I.A.E, F.C.S.I, F.I.S.C.** This dissertation is submitted to The Tamil Nadu Dr. M.G.R Medical University, towards partial fulfilment of requirement for the award of **D.M. Degree (Branch-II) in Cardiology.**

Place : Chennai

Date : 28.0510

DR.S.MURUGAN

ACKNOWLEDGEMENTS

A great many people made this work possible. I thank my Dean for allowing me to conduct this study.

My warmest respects and sincere gratitude to our beloved Prof. Geetha Subramanian, Professor and Head of the Department of Cardiology, Government General Hospital, Chennai. But for her constant guidance this study would not have been possible.

My respectful thanks to Prof R. SUBRAMANIAN for his constructive ideas, personal guidance and involvement in this study.

I am indebted to Prof. B. Ramamurthy, Prof. M. Somasundaram, Prof. P. Arunachalam and Prof. V.E. Dhandapani without whom, much of this work would not have been possible.

I acknowledge Dr M.A. Rajasekar for the many useful comments he made during this project.

In addition, I am grateful to, Dr.G. Gnanavelu, Dr.S. Venkatesan, Dr.G. Ravishankar, Dr. Justin Paul, Dr.C. Elangovan and Dr.G. Prathapkumar for tracing all those waveforms and guidance.

Last but not the least I thank all my patients for their kind cooperation.

CONTENTS

INTRODUCTION

Unstable angina and Non ST segment elevation myocardial infarction [NSTEMI] remain leading causes of morbidity and mortality worldwide. These conditions are part of a continuum of acute coronary syndromes that ranges from unstable angina and NSTEMI to ST segment elevation Myocardial infarction [STEMI].

Acute total occlusion of a coronary artery usually causes STEMI whereas UA/NSTEMI usually results from severe obstruction but not total occlusion of the culprit coronary artery.

The definition of Unstable angina is largely based on clinical presentation. Stable angina pectoris typically manifests as a deep, poorly localized chest or arm discomfort, reproducibly precipitated by physical exertion or emotional stress and relieved within 5 to 15 minutes by rest and/or sublingual nitro-glycerine.

In contrast, unstable angina is defined as angina pectoris or equivalent type of ischaemic discomfort with at least one of the three features: 1] occurring at rest and usually lasting more than 20 minutes [If not interrupted by nitro-glycerine administration] 2] being severe and described as frank pain, and of new onset [i.e., within 1 month] and 3] occurring with a crescendo pattern [i.e., more severe, prolonged or frequent than previously]. Of this group,

NSTEMI is distinguished from UA by the presence of elevated serum levels of cardiac biomarkers.

The putative theory is that the clinical syndrome of unstable angina is caused by rupture of the atherosclerotic plaque with superimposed thrombus formation. It is characterised by angiographically complex coronary lesions in the majority of patients[1]. This anatomy often portends high morbidity[2].

Inflammation has been implicated in the pathophysiology of vulnerable coronary plaques. This is evident from histological studies of coronary lesions demonstrating abundant inflammatory infiltrates in unstable compared to stable plaques.[3-8] Furthermore, the local inflammatory process in the coronary arteries seem to be expressed systemically by a rise in the levels of acute phase reactants and cytokines. C reactive protein is a sensitive early marker of inflammation and has been shown to raise several thousand folds in the presence of an inflammatory process in the body.[9, 10]

Several studies have examined the association of CRP with acute coronary syndromes. C reactive protein rise has been reported before[11] as well as during unstable angina episodes [12]even in the absence of evidence of myocardial injury.[13] The CRP rise is unlikely to be related to ischemia reperfusion injury, since it was absent in patients with the variant angina.[14] Clinically, it appears that elevated CRP predicts a poor prognosis in the

patients with unstable angina, reflected by increased incidence of adverse ischaemic cardiac events. [15-17]

A new paradigm has emerged suggesting a strong link between CRP levels and inflammatory activity in the culprit lesion. This study was designed to explore the correlation of CRP levels with the degree of culprit lesion angiographic complexity in an unselected group of patients with unstable angina. Still there are controversies in regard to management whether to undergo early invasive or conservative strategy. Guidelines suggest conservative treatment with stabilised patients and among them identifying high-risk category based upon risk factors and planning invasive strategy suggested.

AIM

This study aims at usefulness of hs CRP in the identification of complex culprit lesion anatomy in unstable angina patients and thereby identifies high risk category for early revascularisation.

The following parameters were analysed

1. Quantification of hs CRP in clinically high risk patients with UA
2. Analysing Clinical profile of Unstable angina patients with reference to hs CRP
3. To identify any correlation between severity of coronary artery disease with that of hs CRP levels
4. To study clinical outcome and correlation of hs CRP levels in the study population.

REVIEW OF LITERATURE

An etiologic approach has been proposed.[18] Five pathophysiological processes may contribute to the development of UA/NSTEMI. These include 1] plaque rupture or erosion with superimposed nonocclusive thrombus [by far the most common cause of UA/NSTEMI 2] dynamic obstruction [i.e., coronary spasm of an epicardial coronary artery or constriction of the small muscular coronary arteries 3] progressive mechanical obstruction 4] inflammation and 5] secondary unstable angina, related to increased myocardial oxygen demand or decreased supply. Individual's patients may have several of these processes coexisting as the cause of their episode of UA/NSTEMI.

The Pathophysiology of UA/NSTEMI involves a broad timeline with three phases rather than an isolated ischaemic event. Eventhough traditionally focus is on acute event, but pathophysiology may actually begin several decades before the acute clinical event, and then may span more than 20 years afterward.

The central role of coronary artery thrombosis in the pathogenesis of UA is supported by following observations 1] at autopsy, thrombi usually localize at the site of a ruptured or eroded coronary plaques [19] 2] high incidence of thrombotic lesions detected during coronary atherectomy specimens 3] coronary angiography frequently visualizes thrombus 4] coronary angiography has demonstrated ulceration or irregularities suggesting a ruptured plaque and

or thrombus in many patients 5] elevation of several markers of platelet activity and fibrin formation 6] improvement in clinical outcome by antithrombotic therapy.

Rupture of ulceration of an atherosclerotic plaque often exposes the subendothelial matrix to circulating blood results in platelet adhesion followed by platelet activation due to conformational changes in the shape of platelets and provides more surface area for platelet aggregation and release of platelet mediators thrombaxane A2, serotonin and others and the finial end result is platelet plug. Simultaneously with formation of platelet plug, plasma coagulation system activated. Tissue factor triggers and results in activation of Factor X and generates thrombin. Thrombin inturn coverts fibrinogen to fibrin and stimulates platelet aggregation and stabilizes fibrin clot. Factors that contribute to plaque instability include lymphocyte and macrophage activation and increased inflammation. Infection with chlamydia pneumoniae also may be involved.[20]

Vasospasm can be induced by the local production of vasoactive substances released from the subendothelial matrix or propagating thrombus or it can occur as a primary phenomenon. Severe localised spasm of a coronary artery segment may also result in ACS. This vasospasm frequently occurs at the site of unstable plaque and is thought to contribute to thrombus formation. Even angiographically normal coronary arteries with underlying endothelial dysfunction may be subject to vasospasm.

Unstable can also result from a supply demand mismatch of oxygen delivery to the myocardium. With stable obstructive coronary lesions, precipitants of unstable angina include increased myocardial oxygen demand [i.e., tachy cardia, severe hypertension, cocaine use, hyperthyroidism, fever, or sepsis] and decreased oxygen supply [i.e., anaemia or hypoxemia].

Clinical characteristics indicative of high risk include acceleration of ischaemic symptoms within the preceding 48 hours, angina at rest more than 20 minutes, congestive heart failure as evidenced by S3 gallop, pulmonary oedema, rales, known reduced left ventricular function, hypotension, new or worsening mitral regurgitation murmur, age more than 75 years, diffuse ST segment changes on an electrocardiogram and the presence of elevated cardiac biomarkers[typically creatine kinase MB, troponin T, or troponin I]. Patients at intermediate or low risk have angina of short duration, no ischaemic ST-segment changes on ECG, are negative for cardiac biomarkers and are hemodynamically stable.[21]

The likelihood of significant coronary artery disease in patients presenting with chest pain syndrome is as follows: [22]

- High likelihood (includes any of the following features):
    - History of prior myocardial infarction, sudden death, or other known history of coronary artery disease
    - Chest or left arm pain consistent with prior documented angina

    - Transient hemodynamic or ECG changes during pain
    - ST-segment elevation or depression 1 mm or more
    - Marked symmetrical T-wave inversion in multiple precordial leads
- Intermediate likelihood (includes absence of high likelihood features, but one of these risk characteristics is present):
    - Age older than 70 years
    - Male sex
    - Diabetes mellitus
    - Extracardiac vascular disease (peripheral, brachiocephalic, or renal artery atherosclerosis)
    - ST depression 0.05-1 mm
    - T-wave inversion 1 mm or greater in leads with dominant R waves
- Low likelihood (includes absence of high or intermediate likelihood features and any of the following):
    - Chest pain classified as probably not angina
    - Chest discomfort reproduced by palpation
    - T-wave flattening or inversion less than 1 mm in leads with dominant R waves
    - Normal ECG findings

Risk stratification (Prognosis)

After the likelihood for coronary artery disease is determined to be significant, the next step is to stratify the patient's risk for an event. The estimation of likelihood of significant coronary artery disease is critical for identifying high-risk patients who may benefit from more aggressive treatment strategy (i.e., cardiac catheterization).

The TIMI Risk Score for unstable angina/NSTEMI is currently the best-validated prognostic instrument that is simple enough to use in an emergency department setting.[23]

The presence of any of the following variables constitutes 1 point, with the sum constituting the patient risk score on a scale of 0-7:

- Aged 65 years or older
- Use of aspirin in the last 7 days
- Known coronary stenosis of 50% or greater
- Elevated serum cardiac markers
- At least 3 risk factors for coronary artery disease (including diabetes mellitus, active smoker, family history of coronary artery disease, hypertension, hypercholesterolemia)
- Severe anginal symptoms (2 or more anginal events in the last 24 h)
- ST deviation on ECG

Of note, studies have shown that ongoing congestive heart failure, presence/history of poor left ventricular ejection fraction (LVEF), hemodynamic instability, recurrent angina despite intensive anti-ischemic therapy, new or worsening mitral regurgitation, or sustained ventricular tachycardia are significant prognosticators for poor outcome. However, these factors were not evaluated in the TIMI Risk Score model and should be taken into consideration when the level of care is decided.

Factors that were specifically examined but were not found to have prognostic value in the multivariate model include prior myocardial infarction, previous percutaneous transluminal coronary angioplasty (PTCA) or coronary artery bypass graft, or history of congestive heart failure.

The inflection point for death or myocardial infarction starts at a TIMI Risk Score of 3. Therefore, patients with a score of 3-7 should be considered for use of intravenous glycoprotein IIb/IIIa agents, heparin (low molecular weight or unfractionated), and early cardiac catheterization

Classification of unstable angina

The number and diversity of clinical conditions that cause the transient myocardial ischemia of unstable angina along with its varying intensity and frequency of pain have made classification within this disorder difficult.

The Braunwald classification [24] is conceptually useful because it factors in the clinical presentation (new or progressive vs rest angina), context (primary, secondary, or post–myocardial infarction), and intensity of antianginal therapy.

Braunwald Classification of Unstable Angina[24]

Characteristic	Class/Category	Details
Severity	I	Symptoms with exertion
	II	Subacute symptoms at rest (2-30d prior)
	III	Acute symptoms at rest (within prior 48 h)
Clinical precipitating factor	A	Secondary
	B	Primary
	C	Postinfarction
Therapy during symptoms	1	No treatment
	2	Usual angina therapy
	3	Maximal therapy

Patients in class I have new or accelerated exertional angina, whereas those in class II have subacute (>48 h since last pain) or class III acute (<48 h since last pain) rest angina. The clinical circumstances associated with unstable angina are categorized as (A) secondary (anemia, fever, hypoxia), (B) primary, or (C) postinfarction (<2 wk after infarction). Intensity of antianginal therapy is subclassified as (1) no treatment, (2) usual oral therapy, and (3) intense therapy, such as intravenous nitroglycerin.

Cardiovascular events develop unpredictably in patients with widely varying degrees of atherosclerotic disease. The advancement of pathophysiology of atherosclerotic vascular diseases has brought new insight regarding potential indicators of underlying hidden atherosclerosis and cardiovascular risk. Now a days attention has been focused in various novel inflammatory markers, especially C reactive protein. Over the last couple of decades it has been proved hat CRP is the most reliable marker of inflammation. It is 1,35,000 Dalton non-immunoglobin protein, having five identical subunit. The name of the CRP derives from the facts that it reacts with capsular polysaccharide of streptococcus pneumoniae. It is now known that CRP specifically recognizes phosphocholine, the hydrophilic part of phosphatidyl choline of the cell membranes, complexion of the CRP to the cell wall activates complement via classical pathway thus stimulating macrophage and other cells to undergo phagocytosis.

High concentration of hs CRP found in the various conditions:

Coronary artery disease – unstable angina, myocardial infarction

Endocarditis	Obesity
Sepsis	Smoking
Vasculitis	Allograft vasculopathy and graft occlusion

Connective tissue disease – systemic lupus erythematosus, Wegner's granulomatosis

Various recent studies have proved that, quantification of CRP is superior to cytokine assays of interleukin-6, interleukin b1, and tumor necrosis factor for detecting the presence of inflammation in intensive care patients.

Previously, assay for CRP had a sensitivity of about 5mgm/dl. By this assay, its level was detectable only during significant inflammation in most of the individual.

Recent available high sensitivity assay of CRP have allowed studies to be performed on the CRP level of individuals who are apparently healthy.[25]

Various study have proved that certain pathogen notably cytomegalovirus, chlamydia pneumoniae, helicobacter pylori are associated with atherogenesis and development of clinically relevant CAD, perhaps via induction of vascular inflammation. [26]Zhu and colleagues demonstrated that a link between anti CMV antibodies and high CRP level in patients with both an elevated CRP level and seropositivity to CMV versus patients with CMV seropositivity alone. This finding suggests that CMV contributes to atherogenesis by provoking an inflammatory response. Further studies have confirmed that risk of angiographically documented CAD and magnitude of increase in CRP levels are associated with an increased pathogen burden.[27] This association emphasizes the role of the inflammatory response and host defense mechanism in atherosclerosis.

Several studies have shown that measurement of hs CRP either at admission or at discharge in patients of acute coronary syndrome have prognostic value. Liuzzo et al [14] showed that patients with severe unstable angina in absence of myocardial necrosis, hs CRP concentration more than 3mgm per liter at admission were associated with increased incidence of recurrent angina, coronary revascularisation, Myocardial infarction and cardiovascular death. Some group later demonstrated that hs-CRP more than 3mgm per liter at discharge in 53 patients of unstable angina was associated with increased readmission for recurrent ischemia and MI.

Ferreiros et al concluded that prognostic value of hs-CRP measured at discharge was better than determined at admission in predicting adverse outcome at 90 days.[28]

Thrombolysis in myocardial infarction [TIMI 11A] study demonstrated that in UA & NSTEMI patients, markedly increased hs-CRP more that 15mgms/L at presentation in 437 patients was a good predictor of 14 days mortality. Furthermore hs-CRP help to identify those patients with negative troponin who were at increased risk of mortality.[29]

Recent study by DL Weiner et. al [29] showed that hs-CRP more than 5mgm per liter at admission in 150 patients with NSTEMI acute coronary syndrome were associated with an increased incidence of major cardiac events within 6 month regardless of troponin values.

CRP level correlate with clinical severity of CAD and coronary events in both acute and sub acute phases of myocardial ischemia. UA patients with hs CRP more than 3mgm per liter have more ischaemic events in hospital than patients with lower CRP levels. CRP level are significantly lower in patients with stable angina than in those with UA and MI patients.

Bazzino et al compared the prognostic value of stress test and CRP after medical stabilization of UA and it showed that elevated CRP levels associated with adverse events, when compared with stress testing. Moreover an elevated hs-CRP level at time of hospital discharge appears to be amore sensitive and specific test markers for increased risk than a positive stress test.[30]

The Electrocardiogram

The ECG is too often overlooked as a powerful risk stratification tool in patients with UA/NSTEMI. Even minor ST depression (>0.5 mV) is associated is associated with a markedly increased mortality rate. Among 9461 patients enrolled in the PURSUIT (Platelet Glycoprotein IIb/IIIa in Unstable Angina: Receptor Suppression Using Integrilin Therapy) study, mortality at 30 days was 5.1 percent in patients with ST depression versus 2.1 percent among those without ST depression.[31] Patients with isolated T-wave inversion have a more favourable prognosis than do those with ST depression.[32]

Biochemical Markers

Troponin measurements should be used in the risk stratification of patients with UA/NSTEMI to supplement the assessment from clinical and ECG data. Elevated troponin levels strongly predict coronary events over the short-term. The combination of troponin elevation and ST-segment depression identifies a group at particularly high risk.[33, 34] Measuring troponin not just at baseline but also at 8 to 16 hours after admission adds useful prognostic information.[33]

Coronary angiographic trials have demonstrated that in patients with ACS, troponin elevation is associated with multivessel coronary disease, complex lesion morphology, and visible thrombus, as well as with impairment in microvascular function, which is indicative of distal embolization of plaque material and platelet thrombus to the coronary microcirculation. These findings have been confirmed using intravascular ultrasound[35] and explain the consistent association between troponin elevation, even at low levels, and recurrent ischemic events in patients with ACS. The association of troponin elevation with high-risk coronary lesion morphology provides mechanistic insight into studies demonstrating that patients with even minor elevations in cTnT or cTnI derive substantial benefit from an aggressive approach with respect to GPIIb/IIIa inhibitors, low-molecular-weight heparin and an early invasive management strategy.[36–38]

The clinical significance of minor (borderline) elevation in cardiac troponins has generated controversy, because most immunoassays have high variability near the lower limits of detection. An ACC/European Society of Cardiology committee has argued that the diagnostic threshold for MI should be set at the lowest level at which the coefficient of variation (CV) is <10 percent.[39] However, several studies show that patients with "borderline" troponin values (between the lower limit of detection and the level of 10 percent CV) have similar ischemic event rates and derive similar benefit from aggressive therapy as do patients with more markedly elevated troponin values.[37, 40]

Plasma levels of BNP and the N-terminal fragment of its prohormone (NT pro-BNP) may rise in response to cardiac ischemia in proportion to the size and severity of the ischemic insult.[41] In patients with UA/NSTEMI, higher levels of BNP or NT pro-BNP measured at presentation or during hospitalization are associated with a markedly increased risk for subsequent death or heart failure, even among patients with normal troponin levels and no evidence of heart failure[42–44] In a recent substudy of the Aggrastat to Zocor (A to Z) trial involving 2901 patients with ACS, those with persistent BNP elevation >80 pg/mL at 4 or 12 months after ACS had a three- to fourfold increased risk for death at 2 years, compared to patients with persistently low BNP levels.[45] These findings suggest that serial BNP or NT pro-BNP measurements may provide incremental prognostic value in patients following

ACS. Despite robust and reproducible prognostic data, the therapeutic implications of isolated BNP or NT pro-BNP elevation in patients with UA/NSTEMI have not been delineated. Thus, currently, we recommend only selective measurement of BNP and NT pro-BNP in patients with ACS.

Newer Biomarkers

Myeloperoxidase (MPO) is a neutrophil enzyme that has been postulated to play a role in low-density lipoprotein (LDL) oxidation. Among 604 patients presenting to an emergency room with chest pain, initial plasma MPO levels predicted the risk of MI and of major adverse cardiac events at 30 days and 6 months, even among those with negative cTnT levels.[48] The prognostic value of MPO appeared to be particularly robust when measured early after symptom onset, when troponin elevation may not have yet occurred. However, MPO is a nonspecific marker of inflammation and oxidative stress, and elevated levels do not alter therapy in ACS at this time.

The ability of albumin to bind transitional metals such as copper and cobalt is altered in the setting of ischemia. The albumin cobalt binding test measures ischemia-modified albumin (IMA). In one study of 208 patients presenting to the emergency room with chest pain consistent with ACS, sensitivity of IMA to diagnose ACS was 82 percent; and the combined sensitivity of the ECG, cTnT, and IMA was 95 percent, significantly higher than the 53 percent sensitivity of the ECG and cTnT alone.[49] A recent meta-

analysis has validated the high sensitivity and negative predictive value of IMA for detecting ACS, especially in combination with troponin and ECG measurements;[50] specificity, however, is very poor.[49] Increased IMA values are found with infection, cancer, renal or liver disease, and ischemia in organs other than the heart. Thus, most patients with an elevated IMA value will have "false-positive" evaluations for ischemia.

Despite the promise of newer biomarkers for risk stratification in ACS, in practice the only markers that should be measured routinely for risk stratification are troponin I or T.

Stress Testing

Stress testing is often used for risk assessment in patients with UA/NSTEMI. Low-risk and some intermediate-risk patients who stabilize with medical therapy undergo stress testing for advanced risk stratification. Those with high-risk findings, such as large, reversible perfusion defects or ST-segment depression at low exercise levels, should undergo coronary arteriography; those with negative or low-risk results can be treated medically. This approach has been validated in patients with UA/NSTEMI, demonstrating that high-risk abnormalities correlate with a higher event rate during followup

American College of Cardiology/American Heart Association Recommendations for Noninvasive Risk Stratification

High risk (>3% annual mortality rate)

1. Severe resting LV dysfunction (LVEF <0.35)
2. High-risk treadmill (Score > -11)
3. Severe exercise LV dysfunction (exercise LVEF <0.35)
4. Stress-induced large perfusion defect (particularly if anterior)
5. Stress-induced multiple perfusion defects of moderate size
6. Large, fixed perfusion defect with LV dilation or increased lung uptake
7. Stress-induced moderate perfusion defect with LV dilation or increased lung uptake (thallium 201)
8. Echocardiographic wall motion abnormality (involving more than two segments) developing at a low dose of dobutamine (10 mg/kg/min) or at a low heart rate (<120 beats/min)
9. Stress echocardiographic evidence of extensive ischemia

Intermediate risk (1 to 3 % annual mortality rate)

1. Mild/moderate resting LV dysfunction (LVEF 0.35–0.49)
2. Intermediate-risk treadmill score (score –11 to +5)
3. Stress-induced moderate perfusion defect without LV dilation or increased lung intake
4. Limited stress echocardiographic ischemia with a wall motion abnormality only at higher doses or dobutamine involving 2 segments

Low risk (<1% annual mortality rate)

1. Low-risk treadmill (score > +5)
2. Normal or small myocardial perfusion defect at rest or with stress
3. Normal stress echocardiographic wall motion or no change of limited resting wall motion abnormalities during stress

Patients who complete a stay in a chest pain unit without objective evidence of myocardial ischemia can safely undergo stress testing for diagnosis and prognostic purposes either immediately or as an outpatient within the next 24 to 48 hours.

In patients who are unable to exercise, pharmacologic testing with dipyridamole, adenosine, or dobutamine can be used as the stress and sestamibi imaging or echocardiography can be used as a method of assessment. Stress testing is not needed in patients whose clinical features already put them at high risk; and should proceed directly to coronary arteriography.

Coronary Angiography

Risk in coronary patients traditionally has been assessed according to the number of vessels with >50 percent diameter stenosis and the presence and severity of LV dysfunction. However, the relative prognostic impact is probably less with ACS, as the risk of short-term events is dominated by features of the culprit lesion, such as whether it induces ST-segment depression or troponin release.

Among patients with UA/NSTEMI who undergo arteriography, approximately 25 percent will have one-vessel disease, 25 percent will have two-vessel disease, and 25 percent will have three-vessel disease. Ten percent will have significant main stenosis, and the other 15 percent will have coronary luminal narrowing of <50 percent or normal vessels on arteriography.[51] Patients with left main stenosis of at least 50 percent, or three-vessel disease with LV dysfunction, derive a survival benefit from coronary artery bypass surgery. Importantly, patients with no significant lesions at angiography benefit from a reorientation of their management. Noncardiac causes of chest pain should be considered (including pulmonary embolism), as well as "syndrome X" and variant angina. If the coronaries are completely normal, antithrombotic and anti platelet drugs can often be discontinued, and the need for anti anginal medication reassessed. Patients who are most likely to have no significant lesions at angiography tend to be women with no ECG changes. Nevertheless, the finding of no significant lesions at angiography is usually unanticipated. Importantly, symptomatic patients with "normal" coronary artery contrast laminography may have severe coronary atherosclerosis on intravascular ultrasound, with coronary artery remodelling

Risk Models and Risk Scores

Risk models and scores predict a probability for adverse outcomes based on combinations of clinical, ECG, and laboratory data available at presentation. The TIMI and PURSUIT scores were derived from clinical trial databases,

whereas the GRACE (Global Registry of Acute Coronary Events) score was derived from a large international registry.[31,52, 53] Although all three methods discriminate patients at high versus low risk for short- and intermediate-term adverse outcomes, the GRACE model provides better calibration between predicted and observed rates of death.[54,55]

The TIMI score does not include any measurement of heart failure. The GRACE model was developed in a less-selected patient population and includes renal insufficiency as a variable, which are two potential advantages over the other methods. The major advantage of the TIMI score is that it is a simple integer sum that can be calculated at the bedside without a calculator, whereas PURSUIT and GRACE use weighted averages of multiple risk factors and may require a computer to calculate. None of the models incorporates information from newer biomarkers such as troponin, BNP, or CRP.

Prognosis

Prognosis in patients with UA or UA/NSTEMI depends on the combination of the morbidity or mortality expected from the extent of coronary stenosis and LV dysfunction and the short-term risk associated with the culprit lesion and the unstable state of ACS. Risk is highest early after the onset of symptoms.

Published reports concerning UA are influenced by patient selection and treatment and can be quite misleading. The inclusion and exclusion criteria for

clinical trials introduce bias by often eliminating low- or high-risk patients. Comparisons of incidence and outcome of UA/NSTEMI since the adoption of routine troponin testing are problematic, as the proportion of patients classified as NSTEMI has increased and overall mortality risk of NSTEMI may have fallen as a consequence.[56]

Recent data from the GRACE study show a 6-month mortality rate of 6.2 percent in patients with NSTEMI and 3.6 percent in those with unstable angina. Rehospitalisation rates over the 6 month period were approximately 20 percent and revascularization rates approximately15 percent.[57]

Treatment Overview

The aims of therapy for UA/NSTEMI patients are to control symptoms and prevent further episodes of myocardial ischemia and/or necrosis. Beta Blockers, nitrates, and, to a lesser extent, calcium channel blockers reduce the risk of recurrent ischemia. Revascularization eliminates ischemia in many patients. The risk of MI is diminished by antiplatelet and antithrombotic drugs. Aggressive statin therapy plays an increasingly important role following ACS.

Hospitalized moderate- to high-risk ACS patients should be treated with aspirin (ASA), clopidogrel, antithrombin therapy, a beta blocker, statin, and, in selected individuals, a GPIIb/IIIa inhibitor. Furthermore, critical decisions are required regarding the angiographic strategy. One option, commonly termed the early invasive strategy, incorporates an angiographic approach in which

coronary angiography and revascularization are performed unless a contraindication exists. Previously, the most common approach included an initial period of medical stabilization. More recently, many physicians are taking an earlier aggressive approach, with coronary angiography and revascularization performed within 24 hours of admission when possible. The rationale for earlier intervention includes the demonstrated protective effects of adjunctive antiplatelet and antithrombin therapy on procedural outcome; recent data demonstrating no advantage for the "cooling off" period before catheterization[58;] and the desire to shorten hospital stays as much as possible. The alternative approach, the early conservative strategy, is guided by myocardial ischemia, with angiography reserved for patients with recurrent ischemia at rest or a high-risk noninvasive evaluation for ischemia. This strategy is better described as selective invasive as it requires aggressive medical intervention and risk stratification. Regardless of the angiographic strategy, an assessment of LV function should be strongly considered because it is imperative to treat patients who have impaired LV systolic function with both angiotensin-converting enzyme (ACE) inhibitors and beta blockers unless contraindicated, and when appropriate, coronary artery bypass graft (CABG) surgery. When the coronary angiogram is performed, a left ventriculogram usually should be obtained at the same time. When coronary angiography is not scheduled, the patient is evaluated at rest and/or with stress for inducible myocardial ischemia or LV systolic dysfunction.

METHODOLOGY

Patients

Those patients with Unstable angina Class III B admitted to the coronary care unit at the department of cardiology, Madras medical college and general hospital, Chennai between Jan 2010 to April 2010 were enrolled in our study. Patients treated and stabilised with Heparin, antiplatelets aspirin and clopidogrel, statin therapy, betablockers and Angiotensin converting enzyme blockers.

Along with treatment, routine serial investigations of Creatine kinase and Creatine kinase MB done at 6, 12, 24hours. Continuous ECG monitoring was performed on all patients during their stay in the coronary care unit.

Those patients with normal cardiac enzymes and those who fulfil our inclusion and exclusion criteria are enrolled in our study with proper consent. All patients underwent coronary angiography before discharge from the coronary care unit. This study was in accordance with the declaration of Helsinki.

Inclusion Criteria

Criteria for the patients to be included were well defined.

Those patients with unstable angina of Braunwald Class III B included in our study irrespective of sex and age.

Exclusion criteria

1. Patients with evidence of myocardial infarction on admission with corresponding electrocardiographic changes
2. Patients with myocardial infarction within 2 months
3. Patients admitted with Acute Coronary syndrome with elevated serum levels of Lactate dehydrogenase, Creatine kinase, Creatine kinase MB
4. Patients with pulmonary edema on admission
5. Patients with valvular heart disease
6. Patients with evidence of infection
7. Patients with malignancies
8. Patients with inflammatory of disease of any aetiology tend to elevated CRP levels

C-Reactive protein

Blood sample of 5ml collected from all those patients included in the study after getting consent and then immediately serum separated. Separated serum properly preserved in the prescribed cold conditions in the refrigerator and sent for analysis at Thyrocare laboratories on same day and hs-CRP levels estimated with nebulometric technique and properly standardized.

Coronary angiography

Using standard techniques, all patients underwent coronary angiography within 5 days of admission after getting high-risk consent. The angiogram were reviewed independently by two cardiologist blinded to the results of hs-CRP levels. Disease vessels were defined by the presence of a lesion with 40% or more of diameter stenosis. Lesions were characterized according to severity of diameter stenosis [<50%, 50-70%, >70% and 99%, graded from 1 to 4] and morphology according to American heart association/American college of cardiology classification [A, B1, B2 or C graded from 1 to 4].

A complexity score of lesion anatomy was assigned according to the sum of the grade of severity of diameter stenosis and morphology of the lesion. The culprit lesions in patients were identified as follows: presence of only one lesion, correlation with ST-T changes on ECGs during anginal attacks and correlation with findings on echocardiograms. In the remaining patients who had only two lesions with equal complexity scores, one of them was arbitrarily chosen to be the culprit. In patients who had two or more different lesions, the one with highest complexity score was identified as the culprit. There were patients with normal coronary angiogram.

Complexity of the culprit lesion were graded as low [score less than 4], intermediate grade [score 4 & 5] and high grade [6 or more].

Statistical analysis

Those patients with normal hs-CRP levels with unstable angina[Group I] compared with patients with high hs-CRP levels[Group II] in regard to complexity of culprit coronary lesion anatomy with Fischer exact test. Statistical comparison was two tailed and a p value of less than 0.05 was considered statistically significant. Continuous variables analysed with unpaired t test and Mean, Standard deviation, Standard error of Mean and confidence interval of 95% assessed.

RESULTS

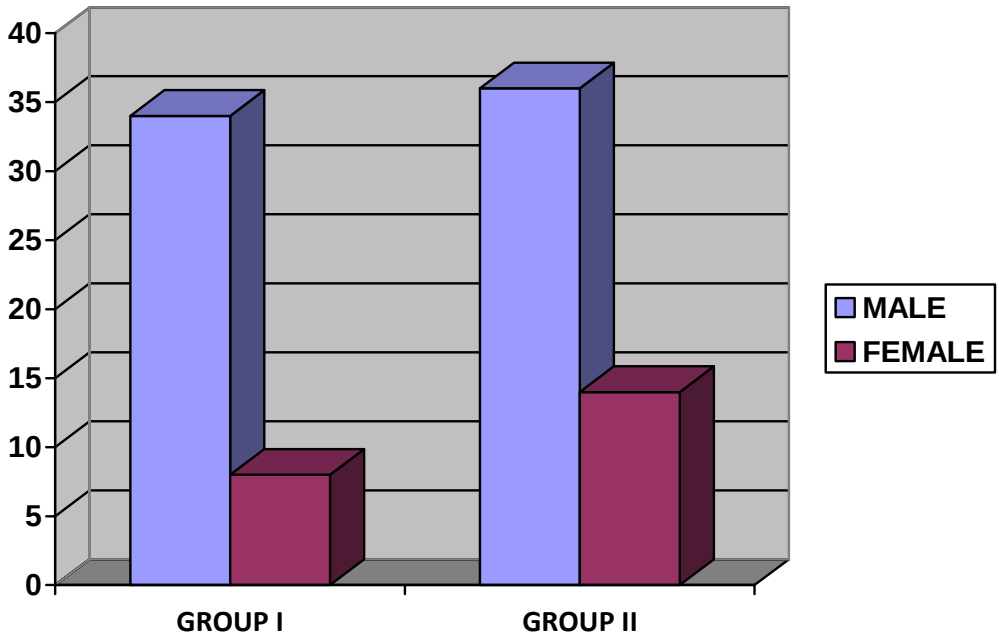
Patients who were admitted and stabilised in CCU and those who fulfilled inclusion criteria and after getting proper consent enrolled in the study. Total of 92 patients with unstable angina and normal CKMB levels underwent coronary angiography after getting proper written consent. The mean time to angiography from admission was approximately 4 days. Among 92 patients, 42 [46%] were with normal hs CRP levels less than 3mgm per litre and 50 [54%] were with high hs CRP levels more than 3mgms per litre. The difference in the number of subjects is not statistically significant. All the patients underwent coronary angiography and procedure was uneventful without any adverse effects.

The mean age of the patients enrolled in Group I with normal hs CRP levels was 49.74+/ 10.05 years and in Group II with elevated hs CRP levels was 51.32+/8.47 years. The difference between both groups were not statistically significant

Table 1 showing Baseline characteristics of Group I with normal hs CRP and Group II with elevated hs CRP levels

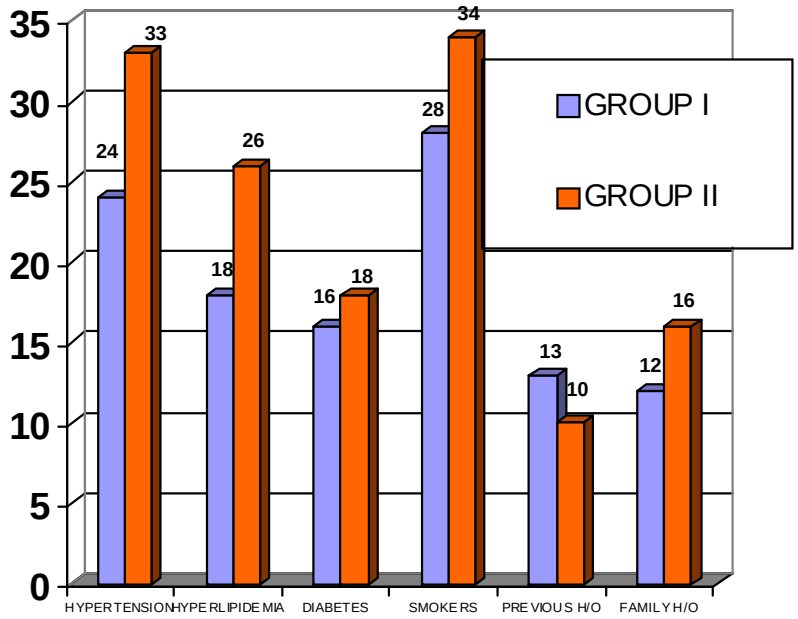
CHARACTERS	GROUP I [hs CRP levels < 3mgms/l]	GROUP II [hs CRP levels > 3mgms/l]	P VALUE	SIGNIFI-CANCE
TOTAL [92]	42 [46%]	50 [54%]	0.3230	NS
AGE IN YRS	49.74 +/ 10.05	51.32 +/8.47	0.4147	NS
MALE 70[76%]	34[37%]	36[39%]	0.3393	NS
FEMALE 22[24%]	8 [09%]	14 [15%]	0.4628	NS
FAMILY H/O CAD 28[30%]	12 [13%]	16 [17%]	0.5020	NS
SMOKERS 62[67%]	28 [30%]	34 [37%]	1.0	NS
DIABETES MELLITUS 34[37%]	16 [17%]	18 [20%]	1.0	NS
HYPERTENSION 57 [62%]	24 [26%]	33 [36%]	0.2930	NS
HYPERLIPIDEMIA 44 [48%]	18 [20%]	26 [28%]	0.4092	NS
HISTORY OF CAD 23[25%]	13 [14%]	10 [11%]	0.1613	NS
PREVIOUS REVASCULARISATION	-	-	-	-

Fig 1 showing Gender distribution of both Group I and Group II



Total number of Males were 70 [76%] and females were 22 [24%]. Males in the Group I with normal hs CRP levels were 34 [37%] compared with Group II with elevated hs CRP levels of 36 [39%] and found to be statistically insignificant [p value =0.3393]. Among 22[24%] females, 8 [09%] were in the Group I and 14 [15%] were in Group II and the difference was statistically insignificant [P=0.4628].

Fig 2 showing Relative frequencies of risk profile of Group I with normal hs CRP levels and Group II with elevated hs CRP levels



Among the risk factors, Smoking and Hypertension were the most common risk factors present in 62[67%] & 57[62%] respectively. Dyslipidemics were 44 [48%] and Diabetics were 34[37%]. Hypertensives were 24 [26%] in Group I with normal hs CRP levels and 33 [36%] in the elevated hs CRP levels and p value is insignificant [p=0.2930]. Dyslipidemia found among 18 [20%] in the Group I and 26 [28%] in the Group II and diffference is statistically insignificant [p=0.4092]. Smokers in the Group I were 28 [30%] and 34 [37%] in the Group II and p value [>.05] is statistically insignificant. In this study, Diabetics were 34 [37%] and out of which 16 [17%]

in the Group I and 18[20%] in the Group II and difference between them is statistically insignificant [p>0.05].

Those with family history of CAD in the study were 28 [30%] and among them, 12 [13%] and 16 [17%] were in the Group I with normal hs CRP levels and Group II with elevated hs CRP respectively. The difference between the two groups is statistically insignificant [p=0.5020]. Those with previous history of CAD were 23 [25%] and distributed in the Group I and Group II as 13 [14%] and 10 [11%] respectively and p value is insignificant [p=0.1613]. All the baseline characteristics among the both groups were comparable and no confounding variable present among them as the values were statistically insignificant.

Table 2 showing CLINICAL PROFILE OF GROUP I AND GROUP II

PARAMETER	GROUP I [N=42]	GROUP II [N=50]	P VALUE	SIGNIFIANCE
PULSE RATE	84.19 ± 7.42	88.40 ± 6.7	P=0.0053	S
SYSTOLIC BP	138.9 ± 11.29	142.2 ± 13.43	P=0.2122	NS
DIASTOLIC BP	86.24 ± 5.68	87.88 ± 6.67	P=0.2117	NS
ECG CHANGES	[14%]	30 [33%]	P=0.0067	S
LV DYSFUNCTION	11[12%]	21 [23%]	P=0.1290	NS
DURATION OF STAY IN CCU	1.02 ± 0.15	2.08 ± 0.85	P=0.0001	S
TIMI RISK SCORE	2.17 ± 1.08	2.28 ± 0.76	P=0.5182	NS

Clinical profile of Group I with normal hs CRP levels and Group II with elevated hs CRP levels were studied. Pulse Rate was 84.19 ± 7.42 in Group I and 88.40 ± 6.7 in Group II. The difference between is statistically significant [p=.0053]. Systolic BP was 138.9 ± 11.29 in Group I and 142.2 ± 13.43 in Group II and P value is statistically not significant [p=0.2122]. Diastolic BP was 86.24 ± 5.68 in group I and 87.88 in Group II and p value is statistically not significant [0.2117]. Those in the Group I stayed in CCU was 1.02 ± 0.15 days and Group II stay in CCU was 2.08 ± 0.85 and the difference was highly significant. [p=0.0001]. TIMI risk score in the group I was 2.17 ± 1.08 and TIMI risk score in the Group II was 2.28 ± 0.76 and there was no statistical difference [p=0.5182]. Those with TIMI risk score 3 and above were 14[15%] in Group I and 21[23% in Group II.

Table 3 showing CORRELATION OF CRP LEVELS AND LV FUNCTION OF GROUP I & GROUP II

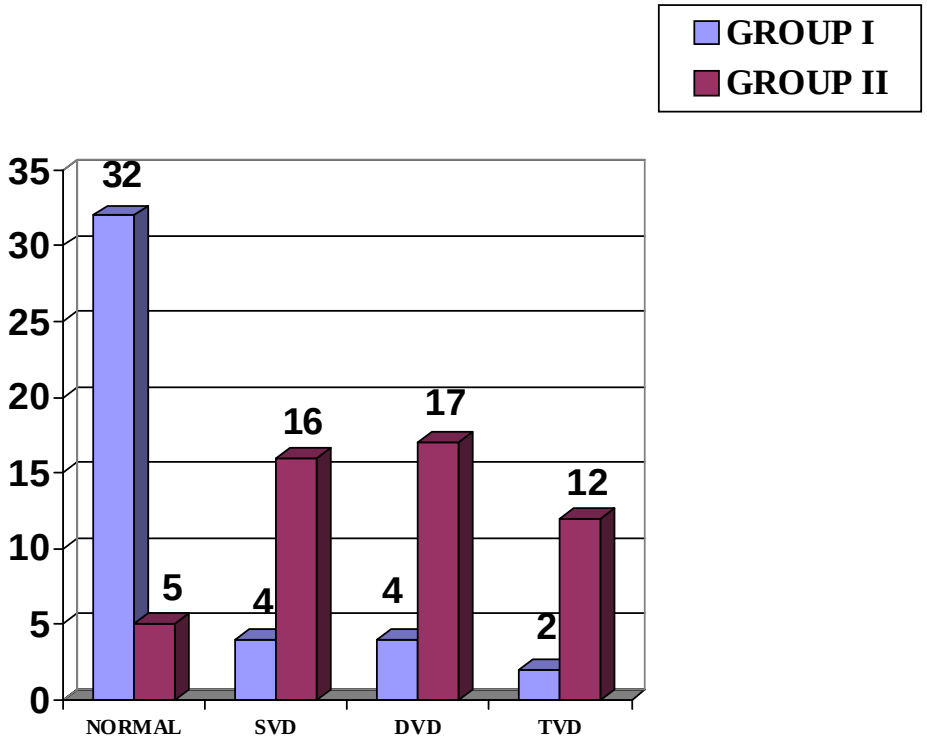
LVF	NORMAL HS CRP LEVELS	HIGH HS CRP LEVELS	TOTAL	PVALUE
NORMAL	31 [34%]	29 [32%]	[66%]	
MILD	7 [8%]	14 [15%]	21 [23%]	
MODERATE	4 [4%]	6 [7%]	10 [11%]	
SEVERE	-	1 [1%]	1 [1%]	
				P=0.1290

There is no statistical difference between Group I and Group II in regard to LV dysfunction in those enrolled in the study. Those with LV dysfunction in Group I were 11[12%] in Group I and 21[23%] in Group II and P value is 0.1290. Among them, those with normal Lv function were 31[34%] & 29[32%] in Group I and Group II respectively. Those with mild and moderate LV dysfunction in Group I were 7[8%] & 4[4%] respectively. Those with mild, moderate and Severe LV dysfunction in Group II were 21[23%], 10[11%] & 1 [1%] respectively.

Table 4 showing DISTRIBUTION OF CORONARY ARTERY DISEASE IN GROUP I & GROUP II

CAD	GROUP I [N=42]	GROUP II [N=50]	TOTAL [92]	P VALUE
NO DISEASE	32 [35%]	5 [05%]	37 [40%]	0.0001[S]
SINGLE VESSEL	4 [04%]	16 [17%]	20 [22%]	0.0112[S]
DOUBLE VESSEL	4 [04%]	17 [18%]	21 [23%]	0.0061[S]
TRIPLE VESSEL	2 [2%]	12 [13%]	14 [15%]	0.0174[S]

Fig 3 showing distribution of coronary artery disease in Group I and Group II



Distribution of coronary artery disease among 92 study patients were No disease 37[40%], Single vessel disease 20 [22%], Double vessel disease 21 [23%] and Triple vessel disease 14 [15%]. In regard to No disease 37 [40%], Group I with normal hs CRP level were 32 [35%] and study group with elevated hs CRP level were 5 [05%] and found to be statistically significant [p=0.0001]. Those with Single vessel disease 20 [22%], those with normal hs CRP level were 4 [4%] and with elevated hs CRP were 16 [17%] and found to be statistically significant. Those patients with Two vessel disease, of 22 [23%], control and study group were 4 [04%] and 17 [18%] respectively and the difference was statistically significant [p=0.0061]. Patients with Triple vessel disease were 14 [15%] and study group with elevated hs CRP were 12 [13%] compared with control group with normal hs CRP level were 2 [2%] and the values were statistically significant [p=0.0174].

Those with coronary artery disease in the study were 55 [60%] and out of which culprit artery localised to LAD in 30 [32%], 5[5%] in Group I and 25 [27%] in the Group II. Circumflex involved in 08[09%]of the study population, of which those with normal hsCRP levels were 2 [2%] and those with elevated hs CRP levels were 6 [7%]. RCA diseased were 17[18%], of which 3 [3%] were from Group I and 14 [15%] were from Group II. All the differences among both groups for localisation of culprit lesion were statistically insignificant.

Table 5 showing Location of the Culprit Lesion

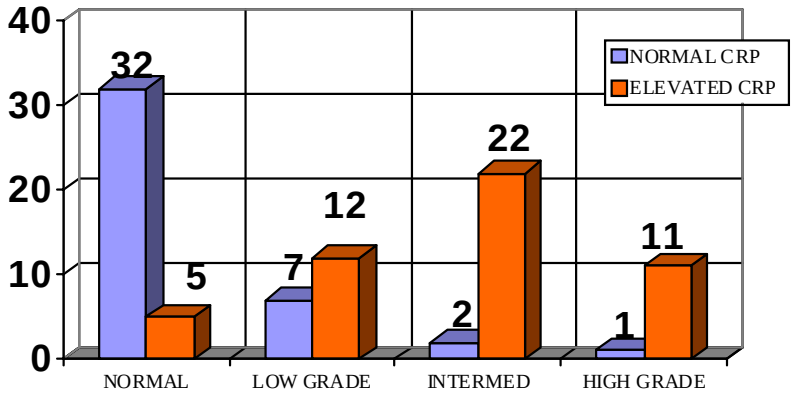
CORONARY ARTERY	GROUP I [N=42]	GROUP II [N=50]	TOTAL	SIGNIFICANCE
LAD	5 [5%]	25 [27%]	30	1.0 ns
CIRCUMFLEX	2 [2%]	06 [7%]	08	0.6273 ns
RCA	3 [3%]	14[15%]	17	1.0 ns

Complexity of the culprit lesion were graded according to the score of anatomical complexity as low, intermediate and high with scores of less than 3, 4&5 and 6 or more respectively and compared in both Group I with normal hs CRP levels and Group II with elevated hs CRP levels. Of 55 patients with coronary artery disease, low grade were 7[7%] in the Group I and 12[13%] in the Group II and the difference is not statistically significant [p=0.4459]. Intermediate grade were 2[3%] in the Group I and 22[24%] in the Group II and p value is statistically significant [p=0.0001]. High grade complexity were 1[1%] in the Group I and 11[12%] in the Group II and the difference is statistically significant. [p=0.0053].

Table 6. Correlation of Complexity of Culprit Lesions Between Group I & Group II

COMPLEXITY	NORMAL hs-CRP [42]	ELEVATED hs-CRP [50]	Total	p value
NORMAL	32[35%]	5[5%]	37[40%]	0.0001[S]
LOW GRADE [SCORE 1,2,3]	7 [7%]	12 [13%]	19 [20%]	0.4459[NS]
INTERMEDIATE [SCORE 4,5]	02 [03%]	22 [24%]	24 [27%]	0.0001[S]
HIGH GRADE [6 OR MORE]	01 [1%]	11 [12%]	12 [13%]	0.0053[S]
ABNORMAL	10[11%]	45[49%]	55[60%]	0.0001[S]

CORRELATION OF COMPLEXITY OF CULPRIT LESIONS BETWEEN GROUP I & GROUP II

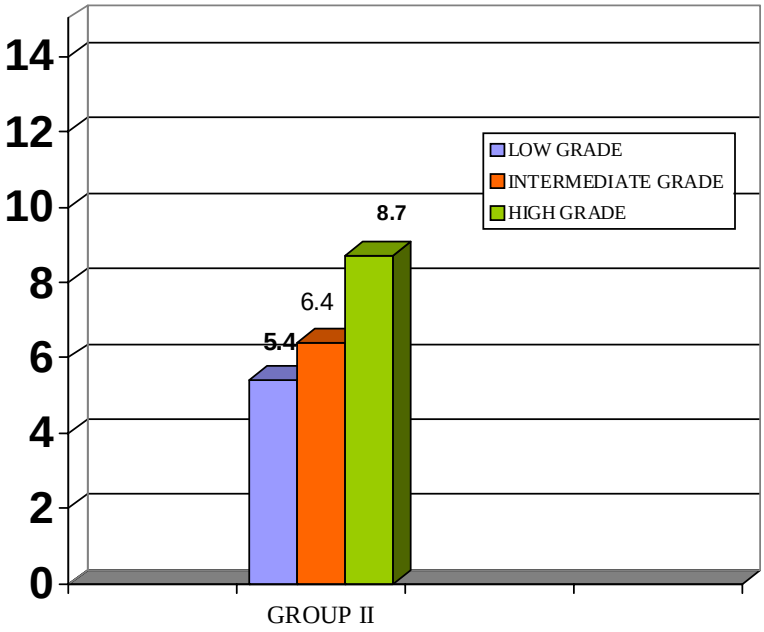


The levels of hsCRP among Group II in correlation with severity of culprit lesion studied. Those with normal and low grade culprit lesions [n=17], Median hs CRP levels were 5.425 with standard deviation of 1.779 and 95% confidence interval being 4.477 to 6.373. Those with intermediate grade lesions [n=22], Median hs CRP levels were 6.435 with standard deviation of 2.086 and 95% confidence interval being 5.53 to 7.33. Those with high grade complex culprit lesions [11], Median hs CRP levels were 8.745 with standard deviation of 1.496 and 95% confidence interval was 7.741 to 9.75.

Table 7. Correlation of CRP with Severity of Lesions in Group II with Elevated CRP Levels

COMPLEXITY	CRP MEAN	S.D	CI 95%
LOW & NORMAL	5.425	1.779	4.477 TO 6.373
MEDIUM	6.435	2.086	5.53 TO 7.33
HIGH GRADE	8.745	1.496	7.741 TO 9.750

Fig 5 showing correlation of hs CRP levels with various grades of Group II patients



Clinical outcome of the study population followed upto May 2010 and No death reported in the study population. Those who underwent PTCA with Stenting done in total of 9 patients, out of which 1 is from Group I and 8 in Group II. Total 8 patients were stented to LAD and 1 patient with RCA. Those who underwent CABG, out of 6 2 were from Group I and 4 in Group II. During short period of observation upto May 2010, 13 were readmitted with diagnosis of unstable angina 7, Acute LV failure 2 and Myocardial infarction 4. In Group I, 2 were admitted with diagnosis of unstable angina & Myocardial infarction. In Group II, Out of 11 patients, 7 were readmitted with unstable angina, 2 with Acute LV failure and 3 with Myocardial infarction [P = 0.03 S].

Table 8. Correlation of CRP Levels with Clinical Outcome of Patient

OUTCOME	GROUP I	GROUP II	SIGNIFICANCE
DEATH	NIL	NIL	-
PTCA 9[10%]	1[1%]	8[9%]	P=0.0347[S]
CABG 6[6%]	2[2%]	4[4%]	P=0.6845[NS]
READMISSION 13 [14%]	2[2%]	11[12%]	P=0.0324[S]
UA 7[7%]	1 [1%]	6[6%]	
LV FAILURE 2[2%]	NIL	2[2%]	
MYOCARDIAL INFARCTION4[4%]	1[1%]	3[3%]	

Figure 6 Showing High Grade Complex Lesion of Mid RCA Lesion

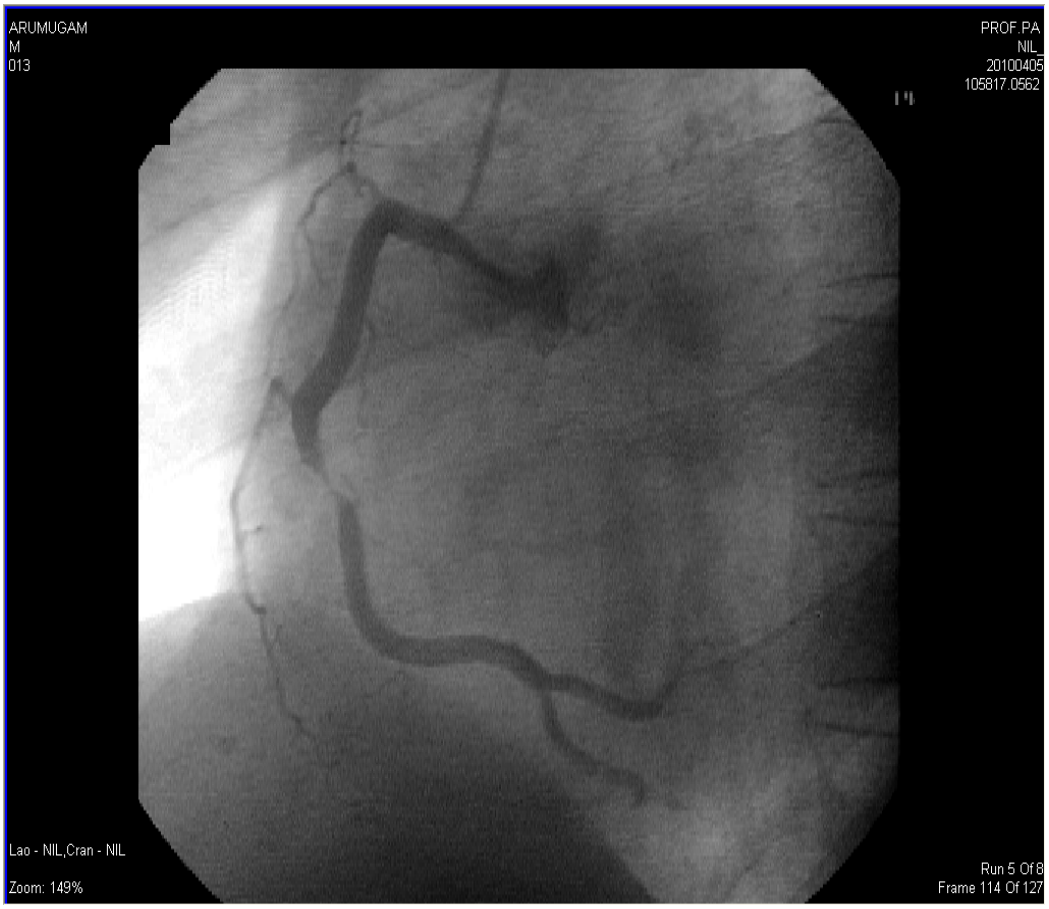


Figure 7 Showing Mid LAD Complex Culprit Lesion

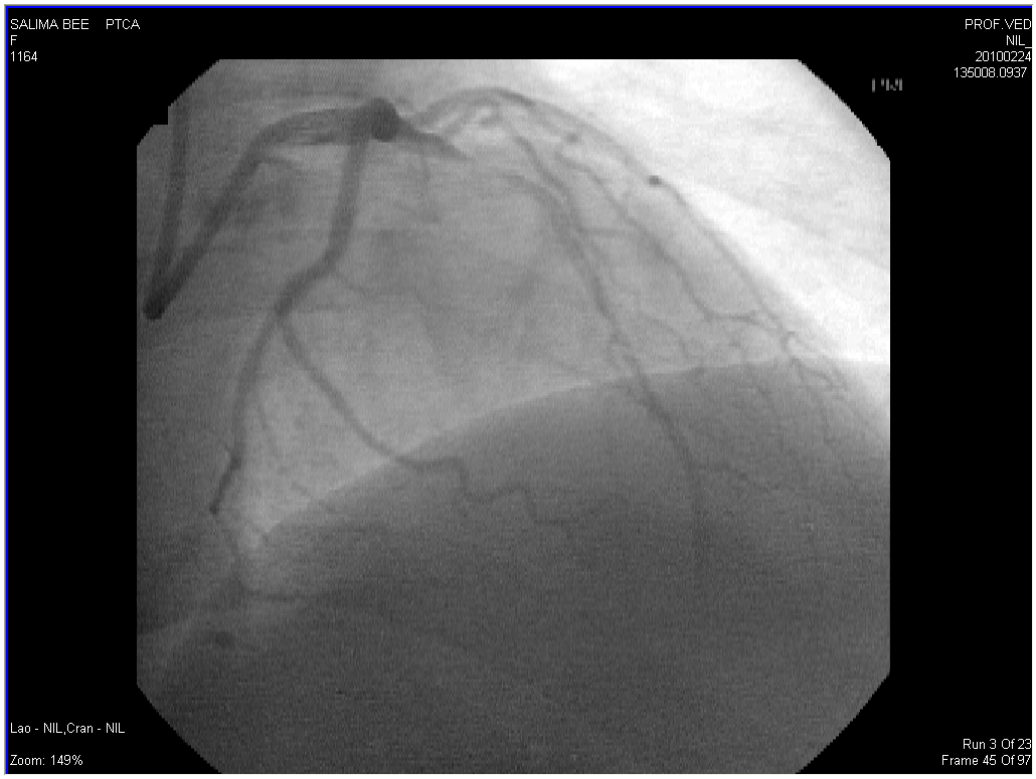


Figure 8 Showing PTCA With Stenting Done To Mid Lad Lesion

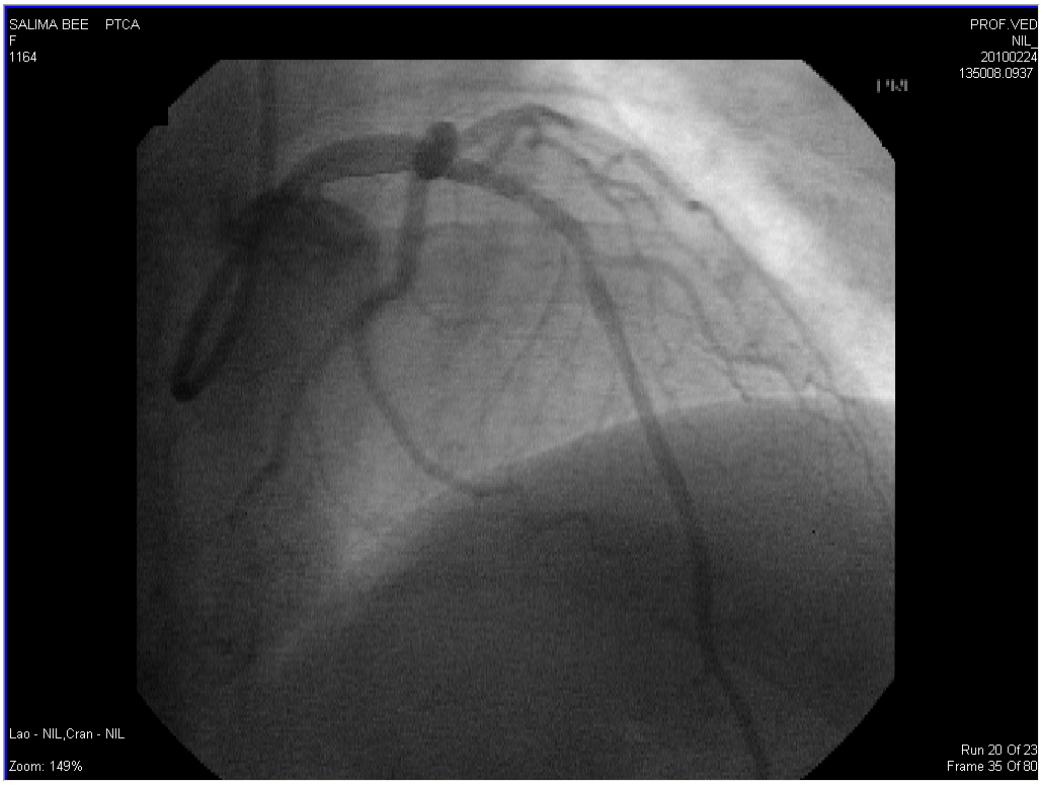


Figure 9 Showing High Grade Culprit Lesion Of Proximal LAD

Figure 10 Showing Post PTCA with Stenting to Proximal LAD

DISCUSSION

The contribution of inflammation to the pathogenesis of the syndrome of unstable angina is emerging as a profoundly relevant factor. Recent molecular biological studies have elucidated the relation between cytokines evoked by activated macrophages and plaque vulnerability. Inflammation causes imbalance between fibrous cap degradation and repair. Several clinical observations have established a quantitative relationship between the degree and level of inflammation and the clinical outcome in symptomatic and asymptomatic patients with coronary artery disease. However, data correlating the markers of inflammation with angiographic anatomy are scarce. This study confirms previous observations relating inflammation and need for revascularisation. It also provides new knowledge pertaining to the link between inflammation and coronary events. We noted significant correlation between elevated CRP levels and the grade of culprit lesions anatomical complexity in patients with unstable angina. Thus, a strong interaction between plaque inflammation and thrombosis seems to be the basis of unfavourable plaque transformation, anatomical complexity and consequent adverse clinical event.

In this study, Total 92 patients who were included, Baseline characteristics compared between 42 [46%] of Group I with normal hs CRP levels and 50 [54%] of Group II with elevated hs CRP patients. There was no

statistical difference between the two groups and thereby both groups compared without confounding variables. Mourkabel et al.[59] studied CRP level with complexity of coronary lesions in Unstable angina included 96 patients with 19 patients were with normal CRP levels and 77 patients were with raised CRP levels. Ghazala irfan et al[60] included 34% of unstable angina patients out of 100 patients in the study of hs CRP and angiographic characteristic of coronary lesions. Ghazala irfan et al included 9 patients with normal hs CRP levels and compared 25 patients with elevated hs CRP levels and also study population included NSTEMI & STEMI. Comparing our study with Mourkabel et al[59] and Ghazala irfan et al.,[60] Group I with normal hs CRP were not only higher in number and also there was no statistical significance between both study and control groups [p=0.3230] and thereby correlation with hs CRP levels with severity of lesions and identification of complex culprit lesion anatomy was true reflection of significance than Mourkabel et al and Ghazala et al.

In our study, out of total 22 [24%] females, there was no statistical significant difference [p=0.4628] between 14 [15%] patients of Group II with elevated hs CRP levels and 08 [09%] patients of Group I with normal hs CRP levels. Ghazala irfan et al included 36% females in the study group and Mourkabel et al included 26% females in the study sample. Study by Ridker et al[61] in regard to " C reactive protein and other markers of inflammation in the prediction of cardiovascular disease in women" and concluded that hs CRP

emerged as the strongest univariate predictor of the risk of cardiovascular events and recommended hs CRP in addition to lipid profile to identify women at risk for cardiovascular events.

In this study, Hypertension, Hyperlipidemia, Smoking and Diabetes are the major risk factors with representation of 62%, 48%, 67% and 37% respectively among study population. Mourkabel et al study population comprised 24% hypertensive, 57% Hyperlipidemia, 62% smokers and 19% diabetics. Ghazala irfan et al included 55% diabetics, 66% hypertensive, smokers 36%. In TIMI 11A sub study[29], study population [630] included diabetics 37%, smokers 26% and hypertensive 62%. Among 57[62%] hypertensive in this study, 24[26%] in the Group I and 33[36%] in the Group II with equal distribution and the difference was not statistically significant [p=0.2930]. Diabetics were 16[17%] in the Group I and 18[20%] in the Group II and the difference was not statistically significant. Dyslipidemia was seen 18[20%] in the Group I with normal hs CRP levels and 26[28%] in the Group II with elevated hs CRP levels and there was no statistical significance between them [p=0.4092]. Smokers were 28 [30%] in the Group I and 34[37%] in the Group II and there was no statistical difference between two groups [p=1.0]. There was no statistical difference between Group I with normal hs CRP levels and Group II with elevated hs CRP levels in regard to risk factors in our study and thereby doesn't influence the end result between both groups.

In our study, 23[25%] with previous history of coronary artery disease with distribution of 13[14%] in the Group I with normal hs CRP levels and 10[11%] in the Group II with elevated hs CRP levels and there was no statistical difference between both groups [p=0.8336]. Mourkabel et al[59] study population included 38% with previous history of CAD and Ghazala et al[60] included 43% with previous CAD. There were no patients in this study with previous history of CABG and PCI but study population in Mourkabel et al. and Ghazala et al. were 16 [16.7%] and 27 [27%]. In TIMI 11 A study[29], Previous history of CAD included 57% with diameter stenosis of coronary arteries more than 50% and also included PTCA 15%, CABG 12% and Previous MI 2.5%

In this study 28[30%] were with family history of Coronary artery disease distributed as 12[12%] in the Group I and 16[17%] in the Group II with no statistical significance [p=0.5020]. Mourkabel et al included study population of 56[58.3%] with family history of Coronary artery disease.

In our study, Mean age of the patients in Group I with normal hs CRP levels were 49.74 ± 10.07 and in Group II with elevated hs CRP levels were 51.32 ± 8.42. The difference between both groups were not statistically significant. The mean age of patients in Mourkabel et al was 57 ± 10 years. The mean age in Ghazala et al. was 59.26 ± 11.04 years. Gusto risk score has given score of 2 for the patients with age in between 50-59 years and this itself

indicates 30 day mortality risk of 0.4% and any other added risk factor may increase 30 day mortality rate significantly.

Clinical profile of the patients in Group I and Group II were studied. Mean pulse rate in Group I was 84.19 ± 7.42 compared with 88.40 ± 6.7 in group II and the difference was statistically significant. This again reconfirms the fact that tachycardia in unstable angina patients was one of the risk factor for the need for early invasive strategy and HR more than 90 included in the risk stratification of Unstable angina patients in Gusto Risk scoring system.

Mean Systolic blood pressure in Group I was 138.9 ± 11.29 and in Group II was 142.2 ± 13.43 and the Mean diastolic pressure in Group I was 86.24 ± 5.6 and in Group II was 87.88 ± 6.67 and the difference were not statistically significant in regard to blood pressure [p=0.05].

ECG changes of ST depression or T inversion were found among 43[47%] of study population. There were 13[14%] in the Group I with ECG changes and 30[33%] in the Group II with ECG changes and the difference were statistically significant [p=0.0067]. This signifies the importance of ECG changes with Unstable angina of high risk category who need early invasive strategy in lieu with TIMI risk scoring System. Analysis of 1473 UA or NSTEMI patients in the TIMI III trial revealed revealed 90% ECG changes includes 10% ST elevation, 33% ST depression and 46% T inversion. Our

study revealed 47% ECG changes with ST depression or Symmetrical T inversion.

Mean TIMI risk score in Group I was 2.17 ± 1.08 in Group I and 2.28 ± 0.76 in Group II and the difference was not statistically significant [p=0.5182]. Those with TIMI risk score 3 or more in Group I were 14 (15%) and 21 (23%) and the difference was not statistically significant underlies the significance of this study. The infliction point of high risk of death in TIMI risk stratification scoring method is 3 or more and the incidence of death, new or recurrent MI, recurrent ischemia requiring revascularisation were 13.2% and more if score is 3 or more.

In our study, There was no statistical difference between Group I and Group II in regard to LV dysfunction for those enrolled in the study. Those with LV dysfunction in Group I were 11[12%] in Group I and 21[23%] in Group II and P value is 0.1290. Among them, those with normal Lv function were 31[34%] & 29[32%] in Group I and Group II respectively. Those with mild and moderate LV dysfunction in Group I were 7[8%] & 4[4%] respectively. Those with mild, moderate and Severe LV dysfunction in Group II were 21[23%], 10[11%] & 1 [1%] respectively. The study population with previous history of CAD were only 23[25%] and thereby influenced statistical power of this variable in this study and need to be studied with more number of patients.

The stay at coronary care unit in Group I was 1.02 ± 0.15 and in Group II was 2.08 ± 0.85 and the difference between the groups were statistically significant. This emphasises that those in Group II with elevated hsCRP were of high risk category and needed more duration for stabilisation.

In regard to distribution of coronary artery disease, Normal coronaries, Single, double and triple vessel diseases were 37[40%], 20[22%], 21[23%] and 14[15%] respectively. Out of total with no disease 37 [40%], Group I with normal hs CRP level were 32 [35%] and Group II with elevated hs CRP level were 5 [05%] and found to be statistically significant [p=0.0001]. Those with Single vessel disease of 20 [22%], group I with normal hs CRP level were 4 [4%] and group II with elevated hs CRP were 16 [17%] and found to be statistically significant[p=0.0112]. Those patients with Two-vessel disease of 22 [23%], Group I and Group II were 4 [04%] and 17 [18%] respectively and the difference was statistically significant [p=0.0061]. Total patients with Triple vessel disease were 14 [15%], study group with elevated hs CRP were 12 [13%] compared with Group I with normal hs CRP level were 2 [2%] and the values were statistically significant [p=0.0174]. Comparing study group with Group I, the difference was statistically significant in all categories and reflects usefulness of hs CRP in all categories of patients for identifying high grade complex lesions in unstable angina.

Mourkabel et al included 25[26%] normal coronaries, 27[28.1%] single vessel disease and 23[24%] double vessel disease and 21[21.9%] triple vessel disease and the difference was statistically significant in the all categories as in our study.

In our study, culprit artery localised to LAD were 30%, LCx were 8% and RCA 17% compared to Mourkabel et al study population of 43.8% LAD, 15.6% LCX and 14.6% RCA. Those with coronary artery disease in this study were 55 [60%] and out of which culprit artery localised to LAD were in 30 [32%]-5[5%] in Group I and 25 [27%]in the Group II. Circumflex involved in 08[09%] of the study population, of which those with normal hsCRP levels were 2 [2%] and those with elevated hs CRP levels were 6 [7%]. RCA diseased were 17[18%], of which 3 [3%] were from Group I and 14 [15%] were from Group II. All the differences between Group I and Group II for localisation of culprit lesion were statistically insignificant. There was no confounding bias in regard to culprit artery for identification of high grade lesions and doesn't influence the end result of this study.

In this study, low grade, intermediate and high-grade complexities of culprit lesion anatomy were 20%, 27%and 13% respectively. Of 55 patients with coronary artery disease, low grade were 7[7%] in the Group I and 12[13%] in the Group II and the difference was not statistically significant [p=0.4459]. Intermediate grade were 2[3%] in the Group I and 22[24%] in the

Group II and p value is statistically significant [p=0.0001]. High-grade complexity was 1[1%] in the Group I and 11[12%] in the Group II and the difference is statistically significant. [P=0.0053].

While analysing Group II in regard to hs CRP levels and complexity of culprit artery lesions, those with normal and low grade culprit lesions [n=17], Median hs CRP levels were 5.425 with standard deviation of 1.779 and 95% confidence interval being 4.477 to 6.373. Those with intermediate grade lesions [n=22], Median hs CRP levels were 6.435 with standard deviation of 2.086 and 95% confidence interval being 5.53 to 7.33. Those with high grade complex culprit lesions [11], Median hs CRP levels were 8.745 with standard deviation of 1.496 and 95% confidence interval was 7.741 to 9.75. This observation in our study reaffirms that increasing hsCRP levels in patients with unstable angina identifies complex high grade culprit artery lesions.

While comparing the results between normal hs CRP levels and elevated hs CRP levels, highest statistical significance found between both groups in those with normal coronaries. There was no statistical significance between group I and group II in regard to low-grade culprit lesion but there was statistical significance between group I and group II in respect to intermediate grade and high-grade complex lesions. In our study, the significance between group I study and group II was not there after excluding normal coronaries.

In study of Mourkabel et al compared 19 with normal CRP and 77 with elevated CRP levels, there was statistical significance between both groups while comparing normal, low, intermediate and high grade lesions even after exclusion of normal coronaries. There was a trend toward a higher grade of anatomical complexity of culprit lesion in patients with elevated CRP levels [p=0.007]. The percent of patients with elevated CRP in Mourkabel et al were 56% in the low complexity lesions, 84% in the intermediate group and 93% in the high complex lesions and the investigators concluded that high CRP levels at admission are a marker for anatomical complex lesions.

Another study done by Espligureal R et al[62] showed that, hs-CRP was significantly higher in patients with acute coronary syndrome compared to chronic stable angina [P=0.004] and correlate with complex angiographic lesion [p=0.001].

Ghazala et al showed that highest CRP levels more than 4mgm/l associated with long lesions, irregular lesions and macroscopic thrombus. Thus inflammation can be implicated in transformation of stable coronary plaque to unstable plaque rupture and Thrombus. Identification of markers indicating propensity of plaque rupture is of clinical importance and hs CRP may be simple and useful in this regard.

Study by JA Ambrose et al [1]"Angiographic morphology and the pathogenesis of unstable angina pectoris" showed that out of 110 patients, type

II eccentric lesions with irregular border or narrow neck were found among 63 patients with unstable angina compared to stable angina patients and found to be high statistical significance and represents ruptured atherosclerotic plaques or partially occlusive thrombi or both.

Liuzzo et al[14] showed that in a subgroup of 31 patients with severe unstable angina and no evidence of myocardial necrosis by admission quantitative cTnT, a serum CRP concentration 0.3mgm/dl [90th percentile of normal distribution] was predictive of more frequent recurrent angina and exhibited associated trends toward higher rates of revascularisation, MI and death. Subsequently, the European concerted action on Thrombosis and Disabilities Study group reported a correlation between elevated CRP and non fatal MI or sudden cardiac death in 2000 outpatients with stable and unstable angina followed prospectively for an average of 2 years, with an odds ratio for these events of 1.81 for patients in the highest quartile of CRP relative to those in the first to fourth quartiles.

In TIMI 11A sub study, C reactive protein is a potent predictor of mortality independently of and in combination with Cardiac troponin in acute coronary syndrome strongly suggests a prognostic role for CRP with respect to short-term mortality. In addition, the present report demonstrates the combined prognostic value of an assay for cTnT and CRP in stratifying patients for mortality risk. Notably, among patients with a negative rapid bedside cTnT

assay, a markedly elevated CRP identifies patients who remain at significantly increased risk for death in the first 14 days and thus confers additional prognostic information above cTnT results alone. Furthermore, we observed that using the rapid cTnT assay and CRP in combination provided a more comprehensive risk assessment with respect to mortality. Patients with unstable angina and NQMI compose a diverse population with a broad range of risk for adverse clinical outcomes (29,30). Thus, the ability to effectively risk stratify patients at presentation should prove useful in triaging patients to the appropriate level of hospital care as well as potentially guiding clinical interventions.

Katiris et al[63] assessed the association of preprocedural CRP concentrations with clinical presentation (unstable angina) and angiographic features of coronary lesions and concluded that among patients with suspected CAD undergoing coronary angiography, increased CRP is strongly associated with unstable angina and with specific high-risk features of the culprit coronary lesions.

Study by Zairis et al[64], C reactive protein and multiple complex coronary artery plaques in patients with primary unstable angina included 228 consecutive patients with PUA who underwent in-hospital catheterization were evaluated. In particular there was a significant gradual increase in either the number of Culprit Lesions, or the presence of apparently thrombus-containing

Culprit Lesions with increasing of CRP tertiles. By multivariate analysis CRP was independently associated with the presence of either multiple Culprit lesions (R.R.=1.8, 95%CI=1.5-2.2, P<0.001), or angiographically apparent thrombus-containing Culprit lesions (R.R.=1.4, 95%CI=1.2-1.7, P=0.03). High plasma levels of CRP may reflect a multifocal activation of the coronary tree in patients with unstable angina. This finding suggests a generalized inflammatory reaction throughout the coronary tree in these patients.

In an unpublished study by panja, mitra et al[65] from IPGMER, Calcutta-Relationship of hs CRP and angiographic characteristics of coronary lesions: An experience in Indian context concluded that hs CRP independently predicted high risk coronary artery lesions [Odds Ratio 2.6 per 9 fold increase in hs CRP 95% Confidence interval 0.9-3.2: p=0.034] and also identified 62 culprit lesions with macroscopic thrombus or eccentric/irregular discrete morphology without total occlusion. Study population included 100 patients with Male 72 and Female 28 in between Jan 2004-June 2004.

Clinical outcome of the study population followed upto May 2010 and No death reported in the study population. Those who underwent PTCA with Stenting done in total of 9 [10%] patients, out of which 1 [1%] is from Group I and 8 [9%] in Group II. Total 8 [9%] patients, 7 [8%] were stented to LAD and 1[1%] patient with RCA. Those who underwent CABG out of 6, 2 [2%] were from Group I and 4 [4%] in Group II. During short period of observation

upto May 2010, 13 [14%] were readmitted with diagnosis of Unstable angina 7, Acute LV failure 2 and Myocardial infarction 4. In Group I, 2 were admitted with diagnosis of unstable angina & Myocardial infarction. In Group II, Out of 11 patients, 7 were readmitted with Unstable angina, 2 with Acute LV failure and 3 with Myocardial infarction.

This study indicates that with short period of stay, Total 13 patients were readmitted with diagnosis of Unstable angina, Acute LV failure and Myocardial infarction and identified high risk category among those with elevated hs CRP levels. The need for earlier revascularisation is high among those with elevated hs CRP levels and establishes the level of hs CRP is one of the important tools in risk stratification of Unstable angina and identification of complex culprit lesion anatomy. Those patients with high grade and intermediate grade complex culprit lesion anatomy were with higher levels of CRP and identifies those who need early invasive strategy to decrease future cardiovascular events.

CONCLUSIONS

Following conclusions were made out after observation of results of 92 patients who were admitted with Unstable angina and grouped according to hs CRP levels:

1. Those with elevated hsCRP levels with more than 3mgms per litre associated with high Grade complex culprit lesion and in turn identified the need for early revascularisation.

2. Clinical parameters of tachycardia, ECG changes and prolonged stay at coronary care unit identifies high risk category among study population compared to TIMI risk score, Prior LV dysfunction, Hypertension.

3. Those with hs CRP levels more than 5.53mgms per litre and Those with hs CRP levels more than 7.741mgms per litre were associated with intermediate and high grade complex culprit lesion in those with elevated hsCRP more than 3mgm per litre

4. Those with elevated hs CRP more than 3mgms per litre were associated with increased incidence of readmission, unstable angina, Acute Lv failure and Myocardial infarction.

LIMITATIONS

Angiography offers only visual information and has limitations. For example, we could only assess the presence of macroscopic thrombi, whereas microscopic thrombi are not uncommon. Vulnerability of plaques to rupture is related to microscopic characteristic of coronary plaques, such as increased macrophages, reduced smooth muscle cells, a large soft lipid core and thin plaque cap. Therefore some non-critical appearing lesions may be at high risk for rupture. This would mean that true relationship between lesion morphology and CRP is probably even stronger than we observed using only coronary angiography.

In this study, there were no study population with prior history of revascularisation. In future, Population with prior history of revascularisation will be growing and the necessity to study those population is the need of the time as their main clinical presentation will be Unstable angina. The role of hs CRP is definitely high and ideal marker for need to redo revascularisation.

False positive hs CRP and normal coronaries eventhough very low in this study but with the back ground of Diabetes being one of the most common risk factor among unstable angina patients, Occult infection always may raise hs CRP and the more ideal methodologies to be evaluated to rule of infection.

Our study population received statins before and after enrolment, the influence statins on hs CRP levels is well known fact and it definitely reduces hs CRP levels. This need to be considered in borderline patients.

Statistical power should be high to conclude association of hs CRP levels with complexity of Culprit artery lesions, TIMI risk scoring, prior LV dysfunction and clinical outcome of the patients.

To assess the natural history of impact of high grade complex culprit artery lesions in correlation with clinical outcome, follow up in this study was short and larger follow will definitely identifies absolute risk associated with high complex lesions.

BIBLIOGRAPHY

1. Ambrose JA, Winters SL, Stem A, Eng A, Teichholz LE, Gorlin R, Fuster V Angiographic morphology and the pathogenesis of unstable angina pectoris. JAm Coll Curdiol1985;5:609-616

2. Freeman MR, Williams AE, Chisholm RJ, Armstrong PW. Intracoronary thrombus and complex morphology in unstable angina.Relation to timing of angiography and in-hospital cardiac events.Circulation 1989;80 17-23

3. Moreno PR, Falk E, Palacios IF, Newell JB, Fuster V, Fallon JT:Macrophage infiltration in acute coronary syndromes: Implications for plaque rupture. Circulation 1994;90:775-778

4. Baroldi G, Silver MD, Mariani F, Giuliano G: Correlation of morphological variables in the coronary atherosclerotic plaque with clinical patterns of ischemic heart disease. Am J Cardiovasc Parhol1988;2:159-172

5. Sato T Increased subendothelial infiltration of the coronary arteries with monocytes-macrophages in patients with unstable angina. Atherosclerosis 1987;68: 19 1-1 97

6. Kohchi R, Takebayashi S, Hiroki T, Nobuyoshi M: Significance of adventitial inflammation of the coronary artery in patients with unstable angina: Results at autopsy. Circulation 1985;7 1 :709-7 16

7. van der Wal AC, Becker AE, van der Loos CM, Das PK: Site of intimal rupture or erosion of thrombosed coronary atherosclerotic plaques is characterized by an inflammatory process irrespective of the dominant plaque morphology. Circulation 1994;89:36-44

8. Wallash E, Weinstein GS, Franzone A, Clavel A, Rossi PA, Kreps E lnflammation of the coronary arteries in patients with unstable angina. TaHeartInstJ 1986;16:105-113

9. Shine B, de Beer FC, Pepys MB: Solid phase radioimmunoassays for C-reactive protein. Clin ChimActa 1981;117:13-23

10. Pepys MB: The acute phase response and C-reactive protein. In Oxford Textbook of Medicine, 3rd ed., p. 1527-1533 (Eds. Weatherall DJ, Ledinnham JGG, Warrell DA). Oxford: Oxford University

11. Inflammation, aspirin, and the risk of cardiovascular disease in apparently healthy men. N Engl J Med 1997;336:973-979

12. Berk BC, Weintraub WS, Alexander RW Elevation of C-reactive protein in “active” coronary artery disease. Am J Curdinl 1990;65:

13. Liuzzo G, Biasucci LM, Gallimore JR, Grillo RL, Rebuzzi AG, Pepys MB, Maseri A: The prognostic value of C-reactive protein and serum amyloid A protein in severe unstable angina. N Engl J Med 1994;331:417-424

14. Liuzzo G, Biasucci LM, Rebuzzi AG, Gallimore JR, Caligiuri G. Lama GA, Quaranta G, Monaco C, Pepys MB, Maseri A: Plasma protein acute-phase response in unstable angina is not induced by ischemic injury. Circulation I996;94:2373-2380

15. Haverkate F, Thompson SG, Pyke SDM, Gallimore JR, Pepys MB: Production of C-reactive protein and risk of coronary events in stable and unstable angina. Lancet 1997;349:462-466

16. Morrow DA, Rifai N, Antman EM, Weiner DL, McCabe CH, Cannon CP, Braunwald E: C-reactive protein is a potent predictor of mortality independently of and in combination with troponin T in acute coronary syndromes: A TIMI 1 I A substudy. J Am Coll Cardiol 1 998;3 1 : 1 460- 1465

17. de Winter RJ, Bholasingh R, Lijmer JG, Koster RW, Gorgels JPMC, Schouten Y, Hoek FJ, Sanders GT Independent prognostic value of C-reactive protein and troponin I in patients with unstable angina or non-Q-wave myocardial infarction. Cardiovasc Res 1999;42:240-245

18. Braunwald E: Unstable angina: An etiologic approach to management. *Circulation* 1998; 98:2219-2222.

19. Davies MJ: The composition of coronary-artery plaques. *N Engl J Med* 1997; 336:1312-1314

20. Mayr M, Metzler B, Kiechl S, et al. Endothelial cytotoxicity mediated by serum antibodies to heat shock proteins of *Escherichia coli* and *Chlamydia pneumoniae*: immune reactions to heat shock proteins as a possible link between infection and atherosclerosis. *Circulation* 1999;99:1560–1566

21. Brian P. Griffin, Eric J. Topol Manual of cardiovascular medicine 3rd edition p.no 28-29

22. Hurst, The heart 12 th edition table no: 59-2

23. Antman EM, Cohen M, Bernink PJ et al. The TIMI risk score for unstable angina/NSTEMI: A method for prognostication and therapeutic decision making. JAMA 2000;284:835-842

24. Braunwald E: Unstable angina: A classification. Circulation 1989; 80410414

25. Roberts WL, sedrick R, Moulton L, Spencer A, Rifai N –Evaluation of four automated high sensitivity C-Reactive protein methods;implications for clinical and epidemiological applications Clin chem 2000;46:461-468

26. Zhu J, Quyyumi AA, Norman JE et al:Cytomegalovirus in the pathogenesis of atherosclerosis: the role of inflammation as reflected by elevated C Reactive protein levels- Journal of American college of cardiology 1999;34[6]:1738-43

27. Zhu J, Nieto FJ, Horne BD, et al: prospective study of pathogen burden and risk of myocardial infarction or death: Circulation 2001:103[1];45-51

28. Ferreiros ER, Boissonnet CP, Pizarro R, Merletti PF, Corrado G, Cagide A, Bazzino OO: independent prognostic value of elevated CRP in unstable angina: Circulation 1999;100:1958-1963

29. David A.Morrow, Nader Rifal, Elliott M.Antman, Debra L.Weiner, Carolyn H,Christopher P.canon, Eugene Braunwald-CRP is a potent predictor of mortality independently of and in combination with Troponin T in acute coronary syndromes: A TIMI 11 A substudy J Am coll cardiol 1998;31[7]:1460-5

30. Bazzino O, Ferreiros ER, Pizarro R et al: CRP and the stress test for the risk stratification of patients recovering from unstable angina: Am J cardiol 2001;87[11]:1235-9

31. Boersma E, Pieper KS, Steyerberg EW, et al. Predictors of outcome in patients with acute coronary syndromes without persistent ST-segment elevation. Results from an international trial of 9461 patients. The PURSUIT Investigators. *Circulation* 2000;101:2557–2567.

32. Mueller C, Neumann FJ, Perach W, Perruchoud AP, Buettner HJ. Prognostic value of the admission electrocardiogram in patients with unstable angina/non–ST-segment elevation myocardial infarction treated with very early revascularization. *Am J Med* 2004;117:145–150.

33. Newby LK, Christenson RH, Ohman EM, et al. Value of serial troponin T measures for early and late risk stratification in patients with acute coronary syndromes. The GUSTO-IIa Investigators. *Circulation* 1998;98:1853–1859.

34. Lindahl B, Venge P, Wallentin L, and the FRISC study group. Troponin T identifies patients with unstable coronary artery disease who benefit from long-term antithrombotic protection. *J Am Coll Cardiol* 1997;29:43–48.

35. Fuchs S, Stabile E, Mintz GS, et al. Intravascular ultrasound findings in patients with acute coronary syndromes with and without elevated troponin I level. *Am J Cardiol* 2002;89:1111–1113.

36. Morrow DA, Antman EM, Tanasijevic M, et al. Cardiac troponin I for stratification of early outcomes and the efficacy of enoxaparin in unstable angina: a TIMI-11B substudy. *J Am Coll Cardiol* 2000;36:1812–1817. [PMID: 11092649]

37. Morrow DA, Cannon CP, Rifai N, et al. Ability of minor elevations of troponins I and T to predict benefit from an early invasive strategy in patients with unstable angina and non-ST elevation myocardial infarction: results from a randomized trial. *JAMA* 2001;286:2405–2412.

38. Heeschen C, Hamm CW, Goldmann B, Deu A, Langenbrink L, White HD. Troponin concentrations for stratification of patients with acute coronary syndromes in relation to therapeutic efficacy of tirofiban. PRISM Study Investigators. Platelet Receptor Inhibition in Ischemic Syndrome Management. *Lancet* 1999;354:1757–1762.

39. Alpert JS, Thygesen K, Antman E, Bassand JP. Myocardial infarction redefined—a consensus document of the Joint European Society of Cardiology/American College of Cardiology Committee for the redefinition of myocardial infarction. *J Am Coll Cardiol* 2000;36:959–969.

40. Pham MX, Whooley MA, Evans GT Jr, et al. Prognostic value of low-level cardiac troponin-I elevations in patients without definite acute coronary syndromes. *Am Heart J* 2004;148:776–782.

41. Sabatine MS, Morrow DA, de Lemos JA, et al. Acute changes in circulating natriuretic peptide levels in relation to myocardial ischemia. *J Am Coll Cardiol* 2004;44:1988–1995.

42. de Lemos JA, Morrow DA, Bentley JH, et al. The prognostic value of B-type natriuretic peptide in patients with acute coronary syndromes. *N Engl J Med* 2001;345:1014–1021

43. Morrow DA, de Lemos JA, Sabatine MS, et al. Evaluation of B-type natriuretic peptide for risk assessment in unstable angina/non–ST-elevation myocardial infarction: B-type natriuretic peptide and prognosis in TACTICS-TIMI 18. *J Am Coll Cardiol* 2003;41:1264–1272.

44. James SK, Lindahl B, Siegbahn A, et al. N-terminal pro-brain natriuretic peptide and other risk markers for the separate prediction of mortality

and subsequent myocardial infarction in patients with unstable coronary artery disease: a Global Utilization of Strategies To Open occluded arteries (GUSTO)-IV substudy. *Circulation* 2003;108:275–281.

45. Morrow DA, de Lemos JA, Blazing MA, et al. Prognostic value of serial B-type natriuretic peptide testing during follow-up of patients with unstable coronary artery disease. *JAMA* 2005;294:2866–2871.

46. Lindahl B, Toss H, Siegbahn A, Venge P, Wallentin L. Markers of myocardial damage and inflammation in relation to long-term mortality in unstable coronary artery disease. FRISC Study Group. Fragmin During Instability in Coronary Artery Disease. *N Engl J Med* 2000;343:1139–1147.

47. James SK, Armstrong P, Barnathan E, et al. Troponin and C-reactive protein have different relations to subsequent mortality and myocardial infarction after acute coronary syndrome: a GUSTO-IV substudy. *J Am Coll Cardiol* 2003;41:916–924.

48. Brennan ML, Penn MS, Van Lente F, et al. Prognostic value of myeloperoxidase in patients with chest pain. *N Engl J Med* 2003;349:1595–1604.

49. Sinha MK, Roy D, Gaze DC, Collinson PO, Kaski JC. Role of "ischemia modified albumin," a new biochemical marker of myocardial ischaemia, in the early diagnosis of acute coronary syndromes. *Emerg Med J* 2004;21:29–34.

50. Peacock F, Morris DL, Anwaruddin S, et al. Meta-analysis of ischemia-modified albumin to rule out acute coronary syndromes in the emergency department. *Am Heart J* 2006;152:253–262.

51. Luchi RJ, Scott SM, Dupree RH, and the Principal Investigators and their Associates of Veterans Administration Cooperative Study No 28. Comparison of medical and surgical treatment for unstable angina pectoris. *N Engl J Med* 1987;316:977–984.

52. Antman EM, Cohen M, Bernink PJ, et al. The TIMI risk score for unstable angina/non-ST elevation MI. A method for prognostication and therapeutic decision making. *JAMA* 2000;284:835–842.

53. Eagle KA, Lim MJ, Dabbous OH, et al. A validated prediction model for all forms of acute coronary syndrome: estimating the risk of 6-month postdischarge death in an international registry. *JAMA* 2004;291:2727–2733.

54. Yan AT, Jong P, Yan RT, et al. Clinical trial--derived risk model may not generalize to real-world patients with acute coronary syndrome. *Am Heart J* 2004;148:1020–1027.

55. de Araujo Goncalves P, Ferreira J, Aguiar C, Seabra-Gomes R. TIMI, PURSUIT, and GRACE risk scores: sustained prognostic value and interaction with revascularization in NSTE-ACS. *Eur Heart J* 2005;26:865–872.

56. Watkins S, Thiemann D, Coresh J, Powe N, Folsom AR, Rosamond W. Fourteen-year (1987 to 2000) trends in the attack rates of, therapy for, and mortality from non-ST-elevation acute coronary syndromes in four United States communities. *Am J Cardiol* 2005;96:1349–1355.

57. Goldberg RJ, Currie K, White K, et al. Six-month outcomes in a multinational registry of patients hospitalized with an acute coronary syndrome (the Global Registry of Acute Coronary Events [GRACE]). *Am J Cardiol* 2004;93:288–293.

58. Neumann FJ, Kastrati A, Pogatsa-Murray G, et al. Evaluation of prolonged antithrombotic pretreatment ("cooling-off" strategy) before intervention in patients with unstable coronary syndromes: a randomized controlled trial. *JAMA* 2003;290:1593–1599.

59. Moukarbel GU, Arnaout MS, Alan SE. C-Rective protein is marker for a complex culprit lesion anatomy in unstable angina. Clin Cardiol 2001; 24:506–10.

60. Ghazala irfan, Mansoor ahmad: Highly sensitive CRP and angiographic characteristics of coronary lesion: J Ayub medical college abbottabad 2008:20[3]

61. RidkerPM, Cushman M, Stampfer MJ, Tracy RP, Hennekens CH: Inflammation, aspirin and the risk of cardiovascular disease in apparently healthy men N England journal of Medicine 1997:336:973-979

62. Espliguero RA, Avanzas P, Sales JC, Aldama G, Pizzi C, Kaski JC. C-reactive protein elevation and disease activity in patients with coronary artery disease. Eur Heart J2004;24:401–8.

63. Katritis D, Korovesis S, Giazitizoglou E, Parissis J, Webbpeploe MM, Kalivias P, et al. C-Reactive protein concentrations and angiographic characteristics of coronary lesions. Clin Chem.2000;47:882–6.

64. Zairis M, Papadaki OA, Monousakis S, Thoma MA, Beldekos DJ, Olympios CD, et al. C- Reactive protein and multiple complex coronary artery plaques with unstable angina. Atherosclerosis 2002;164:355–9

65. Panja; Tropical Heart Disease in India, page 69.

ABBREVIATIONS

ACC	–	American college of Cardiology
ACE BLOCKERS	–	Angiotensin converting enzyme
ACS	–	Acute coronary syndrome
AHA	–	American Heart Association
BNP	–	Brain natriuretic peptide
CABG	–	Coronary Artery bypass Graft
CAD	–	Coronary artery disease
CAG	–	Coronary angiogram
CKMB	–	Creatinine kinase MB iso enzyme
CMV	–	Cytomegalovirus
CRP	–	C reactive protein
DVD	–	Double vessel disease
EF	–	Ejection Fraction
GP II b/III a	–	Glycoprotein II b - IIIa
hs CRP	–	high sensitive C reactive protein
LAD	–	Left anterior Descending Artery
LCX	–	Left circumflex Artery

LV	–	Left ventricle
MI	–	Myocardial infarction
MPO	–	Myeloperoxidase inhibitors
NSTEMI	–	Non ST elevation myocardial infarction
PTCA	–	Percutaneous Transluminal Coronary Angioplasty
RCA	–	Right coronary Artery
S.D	–	Standard Deviation
S.E.M	–	Standard error of mean
STEMI	–	ST elevation myocardial infarction
SVD	–	Single vessel disease
TIMI	–	Thrombolysis in Myocardial Infarction
TVD	–	Triple vessel disease
UA	–	Unstable Angina

NAME AGE SEX

ADDRESS

HYPERTENSION

DM

DYSLIPIDEMIA

TOBACCO USE

ALCOHOL

FAMILY H/O CAD SCD

PREVIOUS CAD

CSA

UA

NSTEMI

STEMI

PREV PTCA/CABG

PRIOR LV DYSUNCTION

H/O PVD CVA CKD

RA/ COLLAGEN DISORDERS
ACUTE FEBRILE ILLNESS,
MALIGNANCY
CHRONIC INFLAMMATORY DISORDER
MEDICAL TREATMENT

PREV

PRESENT

CLINICAL
BRAUNWALD CLASSIFICATION

HAEMODYNAMICS STATUS

PULSE S3

BP RALES

JVP

LV FUNCTION

ADMN

BEFORE CAG

ECG

ADMN

BEFORE CAG

DURING CAG

TIMI RISK SCORE

GUSTO RISK SCORE

BASELINE INV

CBC

RFT

CK

CKMB

6	12	24

HS CRP

TMT

CAG NO	DATE	DONE ON

LMCA

LAD

RI

LCX

RCA

SCORE

PTCA

CABG

MEDICAL

DEATH

READMISSION

UA

LVF

INFARCT

MASTER CHART – I

NAME	AGE	SEX	DIAGNOSIS	HTN	DIAB	SMOKERS	DYSLIPIDEMIA	FAMILY H/O	PR	SBP	DBP	ECG	SCORE	LV FUNCTION	TIMI	HS CRP	GROUP	CCU STAY
RAGUPATHY	52	M	UA	YES	NO	NO	NO	NO	94	140	90	AW ISCHEMIA	8	N	2	10.3	2*	2
ANISHKUMAR	32	M	"	YES	NO	YES	NO	NO	96	160	98	AW ISCHEMIA	6	N	2	10.3	2*	2
CHINNASAMY	55	M	"	YES	NO	YES	NO	YES	78	130	80	IW ISCHEMIA	3	N	2	0.4	1	1
MOHAN	52	M	"	YES	YES	NO	YES	YES	98	140	90	N	N	N	2	10.3	2*	3
KUMARI	55	F	"	YES	YES	NO	NO	NO	88	140	84	N	N	N	1	1.2	1	1
JOSEPH	74	M	"	NO	NO	YES	YES	NO	98	160	80	AW ISCHEMIA	3	MILD	3	5.4	2*	2
ANTHONY	48	M	old AWMI	NO	NO	YES	NO	YES	92	130	80	N	4	MILD	1	6.2	2*	3
PANDIAN	60	M	UA	NO	YES	YES	YES	NO	86	140	92	N	7	N	2	6.4	2*	3
HARISHKUMAR	32	M	"	YES	NO	NO	NO	NO	98	132	84	N	0	N	1	0.8	1	1
CHINNASAMY	55	M	"	NO	YES	YES	YES	YES	94	140	80	N	3	N	2	2	1	1
SALEEMA BEE	40	F	"	YES	YES	NO	YES	YES	96	146	92	N	5	N	2	6.4	2*	1
TAMILARASAN	53	M	"	NO	YES	YES	YES	NO	78	140	90	N	3	N	2	4.8	2*	2
ABDUL RAZAQ	58	M	"	YES	NO	YES	YES	NO	92	156	98	IW ISCHEMIA	4	N	3	8	2*	3
VEERANAM	43	M	"	YES	YES	YES	YES	YES	78	140	90	N	4	N	2	1.8	1	1
PALANI	65	M	"	NO	NO	YES	YES	NO	78	140	80	N	0	N	2	0.8	1	1
SAMUEL	35	M	old AWMI	NO	NO	YES	NO	NO	84	136	84	AW ISCHEMIA	4	MODERATE	3	8.2	2*	2
JEYACHANDRAN	50	M	OLD IWMI	NO	YES	YES	YES	NO	80	120	80	IW ISCHEMIA	n	MILD	4	2	1	1
MARIMUTHU	49	M	OLD IWMI	NO	NO	YES	NO	YES	86	128	80	AW ISCHEMIA	4	MODERATE	3	8.2	2*	3
LAKSHMANAN	55	M	old AWMI	YES	NO	YES	NO	NO	98	140	90	AW ISCHEMIA	7	MODERATE	3	10.3	2*	3
DAULATH BASHA	55	M	UA	YES	NO	YES	NO	NO	96	142	92	N	3	N	1	7.5	2*	1
RAVO	41	M	OLD IWMI	YES	NO	YES	NO	YES	82	146	92	IW ISCHEMIA	0	MILD	4	0.4	1	1
INDIRANI	52	F	UA	YES	NO	NO	NO	NO	92	140	90	AW ISCHEMIA	7	MILD	3	6.4	2*	1
SARASWATHY	60	F	OLD IWMI	NO	NO	NO	NO	NO	82	150	80	AW ISCHEMIA	5	MODERATE	3	5.2	2*	2
HARIDOSS	50	M	UA	YES	YES	YES	YES	NO	96	140	90	N	5	N	2	6.2	2*	2
BABUKANNAN	38	M	"	YES	YES	YES	YES	YES	78	140	90	N	0	N	1	0.6	1	1

EDWARD JOSUA	35	M	"	NO	NO	YES	NO	YES	92	120	80	IW ISCHEMIA	0	N	2	5.6	2*	2
BABYAMMAL	52	F	OLD IWMI	YES	NO	NO	NO	NO	88	146	92	AW ISCHEMIA	0	MILD	3	1.2	1	1
MOHD IBRAHIM	57	M	UA	YES	YES	YES	YES	NO	96	132	90	AW ISCHEMIA	7	N	3	10.3	2*	3
ALPHONSE	57	M	"	NO	NO	YES	NO	NO	80	140	80	N	0	N	2	2.6	1	1
ABDUL KHALID	76	M	"	NO	YES	YES	YES	NO	88	160	80	AW ISCHEMIA	5	N	4	7.4	2*	2
vasudevan	49	M	"	NO	NO	NO	NO	YES	76	120	80	N	0	N	1	0.7	1	1
SARASWATHY	72	F	"	YES	NO	NO	YES	NO	92	160	100	AW ISCHEMIA	6	MILD	3	8.4	2*	2
RAMASAMY	50	M	"	YES	NO	YES	NO	YES	94	150	90	IW ISCHEMI9A	3	N	3	3.4	2*	1
RATHINAM	51	F	"	YES	NO	NO	YES	YES	88	140	90	N	5	N	2	8.4	2*	2
RUKMANI	60	F	"	NO	YES	NO	YES	NO	84	160	80	AWISCHEMI A	3	N	2	4.8	2*	1
GANDHI	47	F	"	YES	YES	NO	YES	YES	80	130	80	N	0	N	2	0.8	1	1
KANNAIYAN	52	M	OLD AWMI	YES	NO	YES	NO	NO	78	148	96	AW ISCHEMIA	3	SEVERE	3	3.8	2*	1
GOVINDAN	60	M	UA	YES	YES	YES	YES	NO	98	180	100	N	7	N	2	8.6	2*	3
HANIFA	53	M	OLD IWMI	NO	NO	YES	YES	NO	88	110	70	AW ISCHEMIA	7	MODERATE	3	7.8	2*	2
AYESHA	48	F	UA	NO	NO	NO	YES	YES	94	120	80	N	0	N	1	0.8	1	1
RAJA	52	M	"	YES	YES	YES	YES	NO	74	132	84	N	0	N	2	0.6	1	1
SUBRAMANI	36	M	"	NO	NO	YES	NO	YES	88	120	80	N	0	N	1	6.2	2*	3
MALLIGA	65	F	"	YES	YES	NO	YES	NO	84	160	90	IW ISCHEMIA	7	MILD	5	2.8	1	1
SIVABALAN	32	M	old AWMI	NO	NO	YES	NO	NO	78	120	80	AW ISCHEMIA	2	MODERATE	3	1.5	1	1
MAHENDRAN	36	M	OLD IWMI	YES	NO	YES	NO	YES	80	124	82	N	0	MODERATE	3	0.5	1	1
SUBRAMANI	52	M	UA	YES	NO	YES	NO	NO	90	160	90	N	5	N	1	4	2*	1
MUNIAPPAN	37	M	"	YES	NO	YES	NO	NO	84	120	80	AW ISCHEMIA	7	N	2	9.6	2*	3
MAHENDRAN	46	M	"	NO	YES	NO	YES	YES	82	130	80	N	5	N	2	4.6	2*	1
CHANDRASEKAR	46	M	"	YES	YES	YES	YES	NO	78	160	90	N	0	N	2	1	1	1
ANBU	35	M	old AWMI	NO	NO	YES	NO	NO	76	130	84	N	0	MILD	2	2.3	1	1
SHEELA	45	F	UA	YES	NO	NO	NO	YES	88	138	88	N	6	N	1	7.8	2*	3
ELANGOVAN	49	M	"	NO	NO	YES	YES	YES	82	126	82	N	0	N	1	0.7	1	1
SELVAM	40	M	"	NO	YES	YES	YES	NO	94	132	80	N	5	N	2	6.3	2*	3

VASANTHA	49	F	OLD AWMI	NO	NO	NO	YES	YES	78	130	80	AW ICHEMIA	3	MODERATE	3	1.3	1	1
SHANKAR	39	M	"	YES	NO	YES	NO	YES	82	140	90	N	0	N	2	0.6	1	1
ANANDI	40	F	"	NO	NO	NO	YES	NO	86	140	86	IW ISCHEMIA	5	N	2	3.8	2*	1
ANGAMMAL	60	F	"	YES	NO	NO	YES	NO	92	160	98	AW ISCHEMIA	8	MILD	2	10	2*	3
BABU	34	M	"	YES	NO	YES	NO	NO	80	146	92	N	0	N	1	1	1	1
VASUDEVAN	54	M	"	NO	NO	YES	NO	NO	98	138	80	N	6	N	1	5.7	2*	2
RAMASAMY	64	M	"	YES	YES	YES	YES	NO	98	156	90	AW ISCHEMIA	6	MILD	3	8.3	2*	3
PILLAIYAPPAN	51	M	"	YES	YES	YES	YES	NO	88	142	92	N	0	N	2	2.5	1	2
MASTHAN	71	M	"	NO	NO	NO	NO	NO	84	160	80	AW ISHCEMIA	4	N	3	2.6	1	1
ALAGUDURAI	57	M	"	NO	NO	NO	NO	YES	82	140	86	N	0	N	1	0.4	1	1
ARUMUGAM	40	M	OLD IWMI	YES	YES	NO	YES	YES	88	148	92	N	5	MILD	3	4.8	2*	1
KUMARI	35	M	"	YES	NO	YES	NO	YES	86	140	90	IW ISCHEMIA	0	N	3	3.7	2*	1
DOSS	40	M	OLD IWMI	YES	YES	YES	NO	NO	74	140	90	N	0	N	3	1.3	1	1
SULTAN	63	M	UA	NO	NO	YES	NO	NO	76	156	78	N	0	N	1	1.3	1	1
PUSHPA	56	F	OLD AWMI	YES	YES	NO	YES	NO	78	140	90	AW ICHEMIA	3	MILD	4	3.9	2*	1
BABU	58	M	OLD AWMI	YES	NO	YES	NO	NO	84	140	90	N	0	MILD	3	0.6	1	1
SUBRAMANI	41	M	UA	NO	NO	YES	YES	NO	78	130	80	N	0	N	1	1.7	1	1
RAMAR	53	M	"	YES	YES	YES	YES	NO	84	142	90	IW ISHCEMIA	0	N	3	2.3	1	1
GOVARDHAN	48	M	"	YES	NO	YES	NO	YES	86	160	90	AW ISCHEMIA	5	N	3	6	2*	2
RAJU	59	M	"	NO	YES	YES	YES	NO	84	140	80	N	6	MILD	2	8.7	2*	3
NARAYANAN	62	M	"	YES	NO	YES	NO	NO	78	140	90	N	0	N	1	0.8	1	1
VELU	47	M	"	YES	NO	YES	NO	YES	92	130	80	AW ISCHEMIA	2	N	3	3.4	2*	1
PERUMAL	62	M	"	YES	NO	YES	NO	NO	98	150	90	N	0	N	1	0.7	1	1
KANNUSAMY	56	M	"	YES	YES	YES	YES	NO	94	140	90	N	5	N	2	4.7	2*	1
KAMATCHI	60	F	"	YES	NO	NO	NO	NO	96	160	90	AW ISCHEMIA	7	MILD	2	7.8	2*	3
ARUMUGAM	56	M	old AWMI	YES	NO	YES	NO	NO	78	154	90	AW ISCHEMIA	4	MILD	4	0.7	1	1
VELAYUDHAM	42	M	UA	NO	NO	YES	NO	NO	72	130	80	N	0	N	1	0.7	1	1
KRISHNAN	55	M	"	YES	YES	YES	YES	YES	82	140	100	AW ISCHEMIA	5	MILD	3	7.8	2*	3

MILLGI JOSEPH	62	F	OLD IWMI	YES	NO	NO	NO	NO	88	140	100	N	0	N	2	0.6	1	1
SARAN	59	M	OLD AWMI	YES	YES	YES	YES	NO	92	160	90	AW ISCHEMIA	6	MODERATE	4	1.3	1	1
SAMPATH	47	M	UA	YES	NO	YES	NO	NO	74	130	80	IW ISCHEMIA	6	MILD	2	9	2*	3
SREENIVASAN	54	M	OLD IWMI	NO	YES	YES	NO	NO	78	120	80	N	0	N	3	1.2	1	1
SARASWATHY	58	F	UA	YES	NO	NO	YES	NO	96	140	90	N	0	N	2	2.6	1	1
MOHAMMED	45	M	"	YES	NO	YES	YES	NO	92	140	90	N	0	MILD	2	3.7	2*	1
RAMANI	48	F	"	YES	NO	NO	NO	NO	94	136	88	AW ISCHEMIA	5	N	2	5.3	2*	1
RAJENDRAN	52	M	"	NO	YES	YES	NO	NO	86	142	86	AW ISCHEMIA	0	N	2	0.4	1	1
RAJI	50	F	OLD AWMI	YES	YES	NO	NO	NO	78	140	90	AW ISCHEMIA	7	MODERATE	4	8.7	2*	3
ARUMUGAM	42	M	UA	YES	NO	YES	YES	NO	92	140	90	AW ISCHEMIA	6	MILD	3	7.6	2*	3
LALITHA BAI	49	F	UA	NO	YES	NO	YES	NO	84	140	80	N	0	N	1	0.8	1	1
	gr I M 49.74	70 M	PREV CAD	YES 57	YES 34	YES 62	YES 44	YES 28	GR I 84.19	GR I 138.95	gr I 86.24	GR I 13		MILD 21	3 & ABOVE	GR Ii	gr 1 42	GR I 1.02
	s.d 10.05	22 F	AWMI 12	NO 35	NO 58	NO 30	NO 48	NO 64	7.42	11.29	5.68	GR II 30		GR I 7		3 to 6=18	gr ii 50	S.D 0.15
	sem 1.55		IWMI 11						1.14	1.74	0.88	TOTAL 38		GR II 14	GR I 14	6 to 9=24		SEM 0.02
			TOTAL 23												21	9-12 =8		
	gr II 51.32								GR ii 88.40	GR II 142.24	Gr ii 87.88	P=0.0067		MOD 10				GR II2.08
	s/d 8.47		GR I 13						6.7	13.43	6.67			GR I 4	GR I 2.17	GR I 1.207		0.85
	sem 1.2		GR II 10						0.95	1.9	0.94			GR II 6	1.08	0.0719		0.12
	p=0.4 147														0.17	0.111		P=0001
									P=0.00 53	P=0.21 22	p=0.2 117			SEV 1				
														GR II 1	GRII 2.28	GR II 6.654		
															0.76	2.095		
															0.11	0.296		
														P=0.1290				
															P=0.5182			

MASTER CHART – II

NAME	GROUP	HS CRP	DIAGNOSIS	LV FUNCTION	CAG		LAD	LCX	RCA	SCORE	NO	CULPRIT A		READ MISSION	Duration of stay
RAGUPATHY	2*	10.3	UA	N	1086	1-Feb	MID 50 DIS	OP 99	PDA 50	8	3VD	LCX			2
ANISHKUMAR	2*	10.3	"	N	1104	9-Feb	MID 90 ECC	MID 90	P 50%	6	3VD	LAD	CABG		2
CHINNASAMY	1	0.4	"	N	1103	9-Feb	MID 70 DIS	N	N	3	SVD	LAD			1
MOHAN	2*	10.3	"	N	1100	9-Feb	N	N	N	N	NO	N			3
KUMARI	1	1.2	"	N	1142	19-Feb	N	N	N	N	N	N			1
JOSEPH	2*	5.4	"	MILD	1096	8-Feb	PROX 50 DIS	N	N	3	SVD	LAD			2
ANTHONY	2*	6.2	old AWMI	MILD	1107	10-Feb	MID 9O DIS	OM2 90	N	4	DVD	LAD	PTCA TO LAD		3
PANDIAN	2*	6.4	UA	N	1106	10-Feb	P99ECC	N	N	7	SVD	LAD	PTCA TO LAD		3
HARISHKUMAR	1	0.8	"	N	1109	9-Feb	n	NIL	NIL	0	N	N			1
CHINNASAMY	1	2	"	N	1108	9-Feb	N	prox lcx 70	N	3	SVD	LCX			1
SALEEMA BEE	2*	6.4	"	N	1112	11-Feb	MID 90 ECC	N	N	5	SVD	LAD	PTCA TO LAD	UA	1
TAMILARASAN	2*	4.8	"	N	1110	11-Feb	D1 50	N	P 70	3	dvd	RCA			2
ABDUL RAZAQ	2*	8	"	N	1117	12-Feb	N	N	M 90	4	SVD	RCA			3
VEERANAM	1	1.8	"	N	1121	15-Feb	PROX 90	NIL	N	4	SVD	LAD	PTCA TO LAD		1
PALANI	1	0.8	"	N	1127	16-Feb	N	NIL	N	0	n	NIL			1
SAMUEL	2*	8.2	old AWMI	MODERATE	1137	18-Feb	P70DIS	OM1 50	N	4	dvd	LAD	PTCA TO LAD		2
JEYACHANDRAN	1	2	OLD IWMI	MILD	1132	17-Feb	P 50 DIS	NIL	MID90	n	dvd	RCA		UA	1
MARIMUTHU	2*	8.2	OLD IWMI	MODERATE	1134	18-Feb	N	OM70	MID 90	4	dvd	RCA		F	3
LAKSHMANAN	2*	10.3	old AWMI	MODERATE	1135	18-Feb	D50	OM50	OP 99	7	tvd	RCA		F	3
DAULATH BASHA	2*	7.5	UA	N	1143	20-Feb	N	OM2 70	N	3	dvd	LCX	PTCA TO LAD	MI	1
RAVO	1	0.4	OLD IWMI	MILD	1144	21-Feb	N	NIL	N	0	n	NIL			1
INDIRANI	2*	6.4	UA	MILD	1145	21-Feb	D170	OM250	PM LONG 90	7	tvd	RCA		UA	1

SARASWATHY	2*	5.2	OLD IWMI	MODERATE	1149	21-Feb	P70EC	N	N	5	SVD	LAD			2
HARIDOSS	2*	6.2	UA	N	1148	21-Feb	M70ECC	N	PDA	50	dvd	LAD			2
BABUKANNAN	1	0.6	"	N	1155	23-Feb	N	NIL	NIL	0	n	NIL			1
EDWARD JOSUA	2*	5.6	"	N	1157	23-Feb	N	N	N	0	n	NIL			2
BABYAMMAL	1	1.2	OLD IWMI	MILD	1161	24-Feb	N	NIL	NIL	0	n	NIL			1
MOHD IBRAHIM	2*	10.3	UA	N	1162	24-Feb	OP90 LS	OM170	PLB70	7	tvd	LAD	CABG		3
ALPHONSE	1	2.6	"	N	1169	25-Feb	N	NIL	N	0	n	NIL			1
ABDUL KHALID	2*	7.4	"	N	1167	25-Feb	M90 ECC	D70	M50	5	tvd	LAD		MI	2
vasudevan	1	0.7	"	N	1170	27-Feb	N	NIL	N	0	n	NIL			1
SARASWATHY	2*	8.4	"	MILD	1172	27-Feb	D90ECCD2	P50	M50	6	tvd	LAD		UA	2
RAMASAMY	2*	1.4	"	N	1177	28-Feb	N	OM170	N	3	SVD	LCX			1
RATHINAM	2*	8.4	"	N	1180	28-Feb	D50	N	P90L	5	dvd	RCA			2
RUKMANI	2*	4.8	"	N	1183	2-Mar	N	N	PDA70	3	SVD	RCA			1
GANDHI	1	0.8	"	N	1186	2-Mar	N	NIL	N	0	N	NIL			1
KANNAIYAN	2*	1.8	OLD AWMI	SEVERE	1188	3-Mar	D1 70	N	N	3	SVD	LAD			1
GOVINDAN	2*	8.6	UA	N	1191	4-Mar	D 99	N	P50	7	dvd	LAD			3
HANIFA	2*	7.8	OLD IWMI	MODERATE	1195	4-Mar	P90L	P50	D50	7	td	LAD			2
AYESHA	1	0.8	UA	N	1198	5-Mar	N	NIL	N	0	N	NIL			1
RAJA	1	0.6	"	N	1199	5-Mar	N	NIL	N	0	N	NIL			1
SUBRAMANI	2*	6.2	"	N	1200	6-Mar	N	N	N	0	N	NIL			3
MALLIGA	1	2.8	"	MILD	1205	6-Mar	OP 90 LS	OM1 70	P 70 ECC	7	tvd	LAD	CABG	MI	1
SIVABALAN	1	1.5	old AWMI	MODERATE	1206	8-Mar	N	N	MID 50 DIS	2	SVD	RCA			1
MAHENDRAN	1	0.5	OLD IWMI	MODERATE	1208	8-Mar	N	NIL	NIL	0	n	NIL			1
SUBRAMANI	2*	4	UA	N	1212	9-Mar	D50	OM190	N	5	dvd	LCX			1
MUNIAPPAN	2*	9.6	"	N	1214	9-Mar	P99ECC	NIL	NIL	7	SVD	LAD	PTCA TO LAD	UA	3
MAHENDRAN	2*	4.6	"	N	1215	10-Mar	N	N	M90ECC	5	SVD	RCA	PTCA TO RCA		1
CHANDRASEKAR	1	1	"	N	1217	10-Mar	N	NIL	NIL	0	n	NIL			1

ANBU	1	2.3	old AWMI	MILD	cag no 1224	11-Mar	N	NIL	NIL	0	n	NIL			1
SHEELA	2*	7.8	UA	N	cag 1223	11-Mar	N	N	P90ECC	6	SVD	RCA		UA	3
ELANGOVAN	1	0.7	"	N	cag 1229	12-Mar	N	N	N	0	N	NIL			1
SELVAM	2*	6.3	"	N	1231	12-Mar	P90ECC	OM150	N	5	DVD	LAD		UA	3
VASANTHA	1	1.3	OLD AWMI	MODERATE	cag 1238	13-Mar	P 50 DIS	P 70 DIS	N	3	DVD	LCX			1
SHANKAR	1	0.6	"	N	cag 1240	15-Mar	N	N	N	0	N	NIL			1
ANANDI	2*	3.8	"	N	cag 1242	15-Mar	N	N	D90L	5	SVD	RCA			1
ANGAMMAL	2*	10	"	MILD	cag 1246	17-Mar	M50	P70	OP99L	8	TVD	RCA	CABG		3
BABU	1	1	"	N	cag 1247	17-Mar	N	N	N	0	N	NIL			1
VASUDEVAN	2*	5.7	"	N	cag 1250	17-Mar	P 90 LS D1	N	PLB70	6	DVD	LAD			2
RAMASAMY	2*	8.3	"	MILD	cag 1252	18-Mar	D50	P90L	PDA 70	6	TVD	LCX			3
PILLAIYAPPAN	1	2.5	"	N	cag 1253	18-Mar	N	N	N	0	N	NIL			2
MASTHAN	1	2.6	"	N	cag 1258	20-Mar	MID 50 DIS	NIL	MID 70 TUB	4	DD	RCA			1
ALAGUDURAI	1	0.4	"	N	cag 1259	20-Mar	N	N	N	0	N	NIL			1
ARUMUGAM	2*	4.8	OLD IWMI	MILD	1260	20-Mar	P90ECC	N	MID 50	5	DVD	LAD	PTCA TO LAD		1
KUMARI	2*	3.7	"	N	cag 1265	22-Mar	N	N	N	0	N	NIL			1
DOSS	1	1.3	OLD IWMI	N	cag 1270	23-Mar	N	N	N	0	N	NIL			1
SULTAN	1	1.3	UA	N	cag 1271	23-Mar	N	N	N	0	N	NIL			1
PUSHPA	2*	3.9	OLD AWMI	MILD	cag 1278	24-Mar	M70D	N	N	3	SVD	LAD			1
BABU	1	0.6	OLD AWMI	MILD	cag 1282	29-Mar	N	N	N	0	N	NIL			1
SUBRAMANI	1	1.7	UA	N	cag 1281	29-Mar	N	N	N	0	N	NIL			1
RAMAR	1	2.3	"	N	cag 1288	30-Mar	N	N	N	0	N	NIL			1

GOVARDHAN	2*	6	"	N	cag 1289	30-Mar	N	50D	M90ECC	5	DVD	RCA			2
RAJU	2*	8.7	"	MILD	1293	31-Mar	D90LON	N	N	6	SVD	LAD			3
NARAYANAN	1	0.8	"	N	1295	31-Mar	N	N	n	0	N	NIL			1
VELU	2*	3.4	"	N	1	1-Apr	N	OM50	N	2	SVD	LCX			1
PERUMAL	1	0.7	"	N	4	1-Apr	N	N	N	0	N	NIL			1
KANNUSAMY	2*	4.7	"	N	7	3-Apr	D70ECC	N	PDA50	5	DVD	LAD			1
KAMATCHI	2*	7.8	"	MILD	11	3-Apr	M99ECC	OM70	PDA70	7	TVD	LAD	CABG		3
ARUMUGAM	1	0.7	old AWMI	MILD	13	5-Apr	D 70 TUB	N	PDA 70	4	DVD	LAD			1
VELAYUDHAM	1	0.7	UA	N	14	5-Apr	N	N	N	0	N	NIL			1
KRISHNAN	2*	7.8	"	MILD	22	5-Apr	MID 50 DIS	N	PR 70 ECC	5	DVD	RCA		MI	3
MILLGI JOSEPH	1	0.6	OLD IWMI	N	23	6-Apr	N	N	N	0	N	NIL			1
SARAN	1	1.3	OLD AWMI	MODERATE	24	7-Apr	MID 90 ECC	OP 70	PDA 70	6	TVD	LAD	CABG		1
SAMPATH	2*	9	UA	MILD	25	7-Apr	P90 ECC NEAR D1	N	PLB50	6	DVD	LAD			3
SREENIVASAN	1	1.2	OLD IWMI	N	31	8-Apr	N	N	N	0	N	NIL			1
SARASWATHY	1	2.6	UA	N	32	8-Apr	N	N	N	0	N	NIL			1
MOHAMMED	2*	3.7	"	MILD	34	9-Apr	N	N	N	0	N	NIL			1
RAMANI	2*	5.3	"	N	37	9-Apr	D70L	N	PDA70	5	DVD	LAD			1
RAJENDRAN	1	0.4	"	N	42	10-Apr	N	N	N	0	N	NIL			1
RAJI	2*	8.7	OLD AWMI	MODERATE	44	10-Apr	D1 50	OM1 70	P TO MID LS 90	7	TVD	RCA			3
ARUMUGAM	2*	7.6	UA	MILD	46	12-Apr	MID 90 LS	N	N	6	SVD	LAD			3
LALITHA BAI	1	0.8	UA	N	54	15-Apr	N	N	N	0	N	NIL			1
	gr 1 42	GR Ii	PREV CAD	MILD 21											
	gr ii 50	3 to 6=18	AWMI 12	GR I 7									CABG 6	UA 7	
		6 to 9=24	IWMI 11	GR II 14									GR I 2	F2	
		9-12 =8	TOTAL 23										GR II 4	MI 3	
				MOD 10											
				GR I 4											
				GR II 6									PTCA 9	GR I 2	
													GR I 1	GR II 10	
				SEV 1									GR II 8		